KBR
Energy Management

Three-phase
network measuring device

multimess

4F144-2-LED-ESMS-...
4F144-2-LED-ESMSDP-...

Your Partner for Network
Analyzing

Dear Customer

We would like to thank you for choosing a KBR GmbH quality product.

In order to familiarize yourself with the operation and programming of the device and always be able to use the whole functionality of this high-quality product, we recommend that you read this manual thoroughly.
The individual chapters serve to explain the technical details of the device and show how to avoid damage by means of proper installation and commissioning.

The manual is included in the scope of delivery of the device and must be accessible for the user at all times (e.g. in the switchgear cabinet). Even when the device is resold to third parties, the manual remains part of the device.

Although we used the utmost care in assembling this manual, we would like to thank you in advance for notifying us about any errors or ambiguous descriptions that might be in it. You will find a form for corrections in the appendix.

Sincerely,

KBR GmbH Schwabach

2009-1 GB

<u>Safety Precautions</u>

This manual contains notes that must be observed for your personal safety and to avoid damage to equipment. Notes are identified by a warning sign or an info symbol according to the degree of hazard they represent.

Danger

means that death, major injuries or damage **will** occur in case the appropriate safety measures are not performed.

Warning

means that death, major injuries or damage **may** occur in case the appropriate safety measures are not performed.

Caution

means that minor injuries or damage may occur in case the appropriate safety measures are not performed.

Note

is an important information on the product, product handling or the respective part of the user manual to which special reference is made.

Disclaimer

The contents of this manual has been checked with the described hardware and software components. Certain deviations, however, cannot be excluded, so the manufacturer is not liable for complete conformity. The specifications made in this manual are checked on a regular basis, necessary corrections are included in the next revision.
We appreciate your corrections and comments.

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General Safety Precautions

In order to prevent operating errors, handling of the device is kept as simple as possible. This way, you will be able to use the device very soon.

In your own interest, however, you should read the following safety precautions carefully.

⚠ Warning

During installation, the applicable DIN / VDE regulations must be observed!

Mains connection, setup and operation of the device must only be performed by qualified personnel. Qualified personnel as understood in the safety precautions of this manual are persons authorized to setup, ground and mark equipment, systems and wiring systems in accordance with applicable standards.

To avoid the hazard of fire and electrical shock, the device must not be subjected to rain or other humidity!

Before the device is connected to the mains, you will have to check whether the local mains conditions comply with the specifications on the manufacturer's label. A wrong connection may destroy the device!

When connecting the device, the connection chart must be observed (see chapter "Connection chart") and the connection lines must be powerless. Only use proper line material and watch the correct polarity when wiring!

In order to ensure proper and safe operation of the product, it must be transported, stored, installed and mounted in accordance with the specifications and operated and maintained carefully.

A device showing visible damage must by all means be considered as unfit for operation and must be disconnected from the mains!

Error detection, repairs and maintenance work may only be carried out in our facilities or after contacting our service team. Every warranty obligation of the manufacturer expires if the device is opened without written consent from our service team. Proper operation can no longer be guaranteed!

Opening the device may expose parts under voltage. Capacitors in the device may still be loaded even if the device was disconnected from all voltage sources. It is generally not allowed to operate the open device!

In facilities subject to hazard of lightning, lightning protection must be provided for all input and output lines (recommendations see chapter "Protective measures")!

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Product Liability

With these product, you have acquired a quality product.

In its manufacture, only components of the highest reliability and quality were used. Each device is subject to long-term testing before it is delivered.

For information on product liability, please refer to our General Terms and Conditions for electronic devices**.**

The warranted properties of the device apply only if it is operated in accordance with its underlined use!

Disposal

Please dispose of defective, outdated or no longer used devices properly.
At your request, we will be pleased to dispose of the devices for you.

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Table of Contents

1   Device memory, battery buffered

The device is equipped with an internal data memory, which is battery buffered to preserve long-term data. To prevent it from being discharged, this backup battery (e.g. Varta CR 2032) is not built in when the device is delivered, but included separately in the delivery.

> **⚠ Caution**
>
> **Before the initial commissioning of the device, please insert the backup battery first (as described in the following), as otherwise all storage data would be lost in case of a power failure.**

Inserting or replacing backup battery:

1. Disconnect the device from the supply voltage.
2. Lift the upper casing cover (frame) with a suitable tool (e.g. a small screwdriver).
3. Lift the front cover.
4. To replace it, remove the empty battery from the clamp pressing slightly against the contact spring using pliers.   **Caution! To avoid short-circuiting, the tips of the pliers have to be insulated.**
5. Press the new battery slightly against the contact spring and into the clamp, until it clicks into place. **Ensure proper polarity!**
6. Reattach the front cover.
7. Put the device frame back into place and push until it clicks into place.
8. Reconnect the device to the supply voltage.

> **⚠ Caution**
>
> **As, when the battery is empty or has been removed and there is no supply voltage, not only the storage data are lost, but the time is not correct anymore either, the time has to be reset in Visual Energy with the corresponding command, or manually on the device (see menu item manual "Setting time and date" in the manual).**

Contact spring

Battery clamp
Battery

Front cover

Device frame
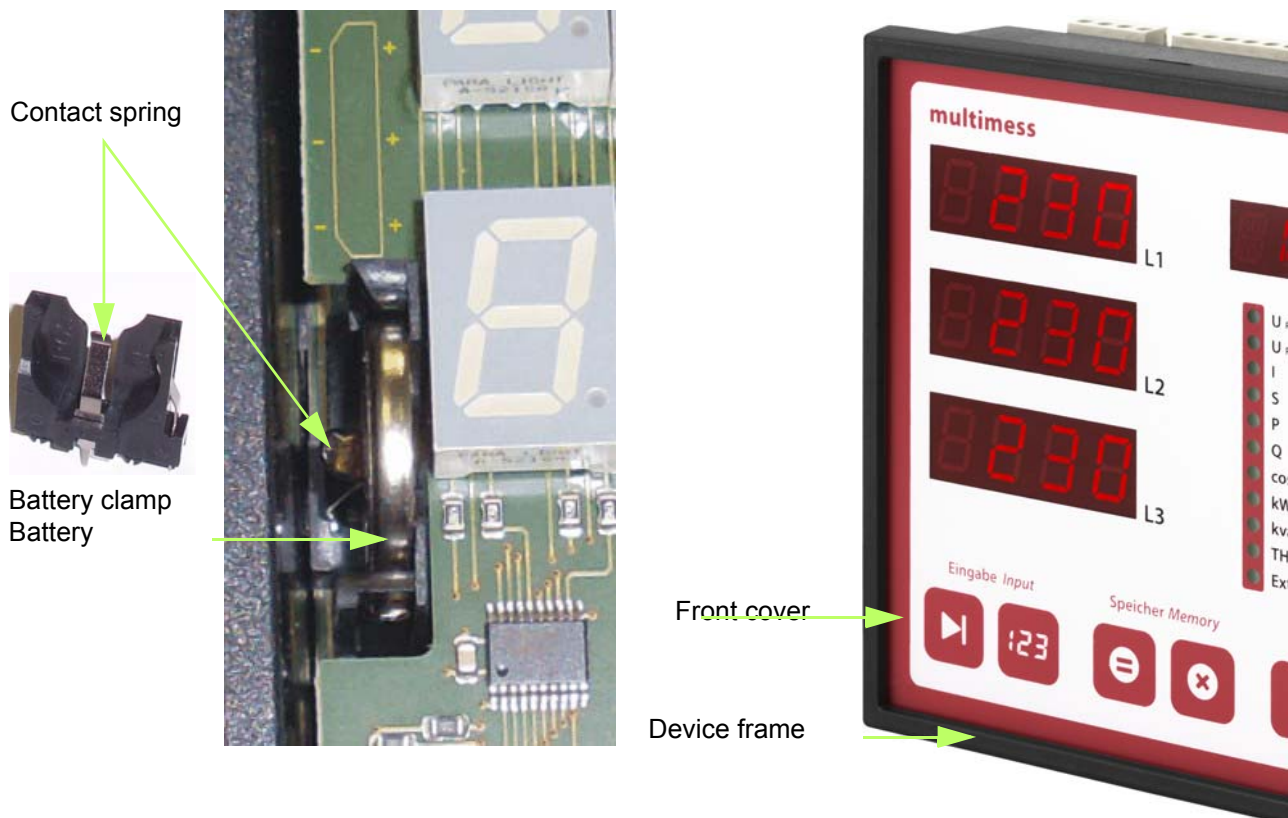
2 Definition of Terms

Below, you will find brief explanations of the terminology used in this manual.

Root-mean-square value:	By definition, the square of the mean value of a periodic or pulsating value is referred to as the root-mean-square value. **multimess 4F144-2-LED-ESMS-...** exclusively uses the effective values of pure periodic values (RMS).
Instantaneous root-mean-square value:	Is the value determined by the **multimess 4F144-2-LED-ESMS-...** within its measuring interval.
Measuring interval:	Within a measuring interval, the electrical quantity "voltage" or "current" of **one** phase is scanned. The resulting scanning spots are available for further calculations. This interval is mainly determined by the A/D conversion.
Measuring cycle:	The measuring cycle is the time the device needs for measuring all possible quantities for all three phases.
Firmware:	Operating system software implemented in the **multimess 4F144-2-LED-ESMS-...**'s microcontroller
Load profile memory:	Saves the actual values of the measuring periods with timestamp.
Measuring period max:	The measuring period containing the highest (maximum) value that occurred.
Active / reactive power periods	Actual active or reactive power within a measuring period.
Measuring period:	The period of time used to determine the average power demand. Typical intervals: e.g. 15, 30, 60 minutes.

3   Field of application / function range

The **multimess 4F144-2-LED-ESMS-...** is an affordable network measuring device for flush mounting for the measurement of all important values in three-phase networks.
The **multimess 4F144-2-LED-ESMS-...** microprocessor records mains voltage and current consumption of the measuring point for all three phases – via analog/digital converter inputs – and calculates the relation of active, reactive and apparent power in the three-phase network.

Convenient operation and display
The LEDs L1, L2 and L3 allow you to view the measured values directly, and also to enter the respective parameters and configuration data. In addition, eleven LEDs serve to indicate menus and the status. Six sensor buttons facilitate navigation through the menus.

For 100 to 400 V networks
The **multimess 4F144-2-LED-ESMS-...** can be applied in three-wire as well as four-wire networks. The unit can be implemented in 100 V as well as in 400V networks for direct measurement. Higher voltages can only be connected via external voltage transformers; whereby primary and secondary voltage can be freely programmed. The measurement voltage inputs of the device measure directly, i. e. they are not metallically separated by a voltage transformer!
For energy supply networks with outer conductor connected to the earth potential, suitable control gear with electrical isolation (e.g. voltage transformer) must be used.

x/5A or x/1A freely programmable
The measuring inputs for current **must always** be fed via current transformers, while the transformer ratio is programmable. The primary current value as well as the secondary current value can be selected.

Determining the neutral conductor current
The neutral conductor current is determined and displayed.

Harmonic oscillation analysis
Harmonic oscillation analysis via Fourier transform.
The **multimess 4F144-2-LED-ESMS-...** measures the harmonic oscillation of the 3rd / 5th / 7th / 9th / 11th / 13th / 15th / 17th and 19th network harmonics of the voltage and calculates their partial oscillation as well as the total distortion factor of the voltage and the distortion reactive current.

Two-tariff counter function (HT/LT)
Consumptions during high and low tariff intervals are stored separately. Switching from high to low tariff times and vice versa is either carried out by means of a digital signal to be applied externally, e.g. from the energy supplier, or via an internal clock. When operated with the KBR Energy Bus, switching can also be carried out centrally via the MULTIMASTER or computer.

Programmable pulse output
Active energy or reactive energy proportional pulses can be output via a programmable output laid out as S_0 interface. The pulse output type (in proportion to active or reactive energy) as well as the pulse values (number of pulses per kWh or per kvarh) and the pulse length can be programmed. These pulses can be processed by, for example, a master system for data acquisition or optimization, a maximum demand monitor or a central process control.

Serial port
In its default configuration, the **multimess 4F144-2-LED-ESMS-...** has a serial port (RS485) for operation with the KBR Energy Bus.
A large amount of information that cannot be shown on the display can be read from the device via the bus. Numerous online measuring values as well as a considerable amount of data can be read from the long-term memory.

Extensive memory functions

In addition to its counting functions, the **multimess 4F144-2-LED-ESMS-...** offers extensive memory functions:

- a **load profile memory** to record the cumulated active and reactive power
- a memory to record the **daily energy values** for 365 days
- as well as an **event memory**, recording defined actions of the measuring device, like power failures, tariff switches, delete functions, and many more.

These memory functions are exclusively available via the KBR Energy Bus.

Synchronization

For the synchronization of the load profile memory, an individual digital input was integrated in the **multimess 4F144-2-LED-ESMS-...**. The synchronization signal of the energy supplier counter can be connected there, for example. Synchronization as well as high / low tariff switching can be controlled centrally via the KBR Energy Bus as well as via the internal clock.

Analog outputs

At these outputs, different parameters can be output as analog values either between 0-20mA or 4-20mA or 0-10 Volt or 2-10 Volt.
Depending on which quantity should be output, you can assign it for a certain phase (L1, L2, L3) or for its total value to the analog output.

Software (optional)

A number of software products that can be run on most Microsoft® Windows® operating systems is available for the convenient programming and storage of long-term data.

Separate power supply

The device requires a separate auxiliary voltage for operation (see nameplate).

For questions on this device or on our software products please do not hesitate to contact us. We will be glad to assist you.
Please see the cover sheet of this manual for your contact.

4   Connection of the multimess 4F144-2-LED-ESMS-...

4.1   Installation and assembly

- During installation, the applicable VDE regulations must be observed.
- Before the device is connected to the power supply, you will have to check whether the local power supply conditions comply with the specifications on the nameplate. A wrong connection may destroy the device. A different power frequency influences the measurement accordingly.
- The device must be connected in accordance with the connection diagram.
- In case the facility is subject to lightning hazard, lightning protection measures for the power supply input must be implemented.

Caution

The control voltage as well as the applied measurement voltage of the device must be protected by means of a back-up fuse.

When connecting the current transformers, the direction of the energy flow and the correct assignment to the voltage paths must be observed!

For the wiring of the pulse output, we recommend to use twisted pair and shielded material exclusively to avoid disturbance (e.g. installation line I-Y(ST) Y 2x2x0.8mm, the shielding may only be connected on one side).

During installation, please also observe our notes on safety measures against overvoltage and lightning in the chapter "Protective Measures" of this manual.

Note

You should take the following points into consideration when connecting the device to the three-phase network to be measured:
- Energy flow direction
- Assigning measurement voltage input / current transformer input

Rotary field:

The unit can be operated in a clockwise or an anti-clockwise rotating field. When switching on the device's power supply, the **multimess 4F144-2-LED-ESMS-...** automatically checks the rotary direction. Rotary field check:

- Connect **only** the **measurement voltage** to the device (U_{Meas} see nameplate).
- Switch on the device by applying voltage to the power supply connections (L and N). Immediately after the device has been switched on, it will check the mains rotary direction.
- The rotary field is displayed in the menu U_{PH-PH}, submenu Rot.field.
- For a clockwise rotary field, the display shows L1 **0**, L2 **120** and L3 **240** degrees.
- If you want to change the rotary direction, you only have to exchange two terminals, i.e. two phases. Then switch the device OFF and ON again. The display now shows the correct voltage and the device starts measuring automatically.
- Then check again whether the assignment of the voltage path L1 and the current path L1 as well as for all other phases is still correct.

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Current transformation connection:

- **Energy flow direction:**
  When mounting the transformers, observe the current flow or energy flow direction. If the current transformer is mounted the wrong way, the measured value will be negative.
  A prerequisite is that energy is consumed.

- **Assigning measurement voltage input / current transformer input:**
  The current transformer on terminal 20/21 (k1/l1) must be arranged in the phase where the measurement voltage for the terminal 10 (L1) is measured. The same applies to the other transformer and measurement voltage connections.

  ⇨ The phase sequence can be checked with the **multimess 4F144-2-LED-ESMS-...** as follows:
  - Switch to the main menu "I".
  - Connect the current transformer to the corresponding wires.
  - The device will display only positive currents when connection and energy flux direction are correct.
  - If connections are wrong, all currents will be negative. Interchange the connections until the display shows correct values.

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⚠ **Caution**

   Before any interchanging the transformers must be shorted out!

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4.2 Connection diagram
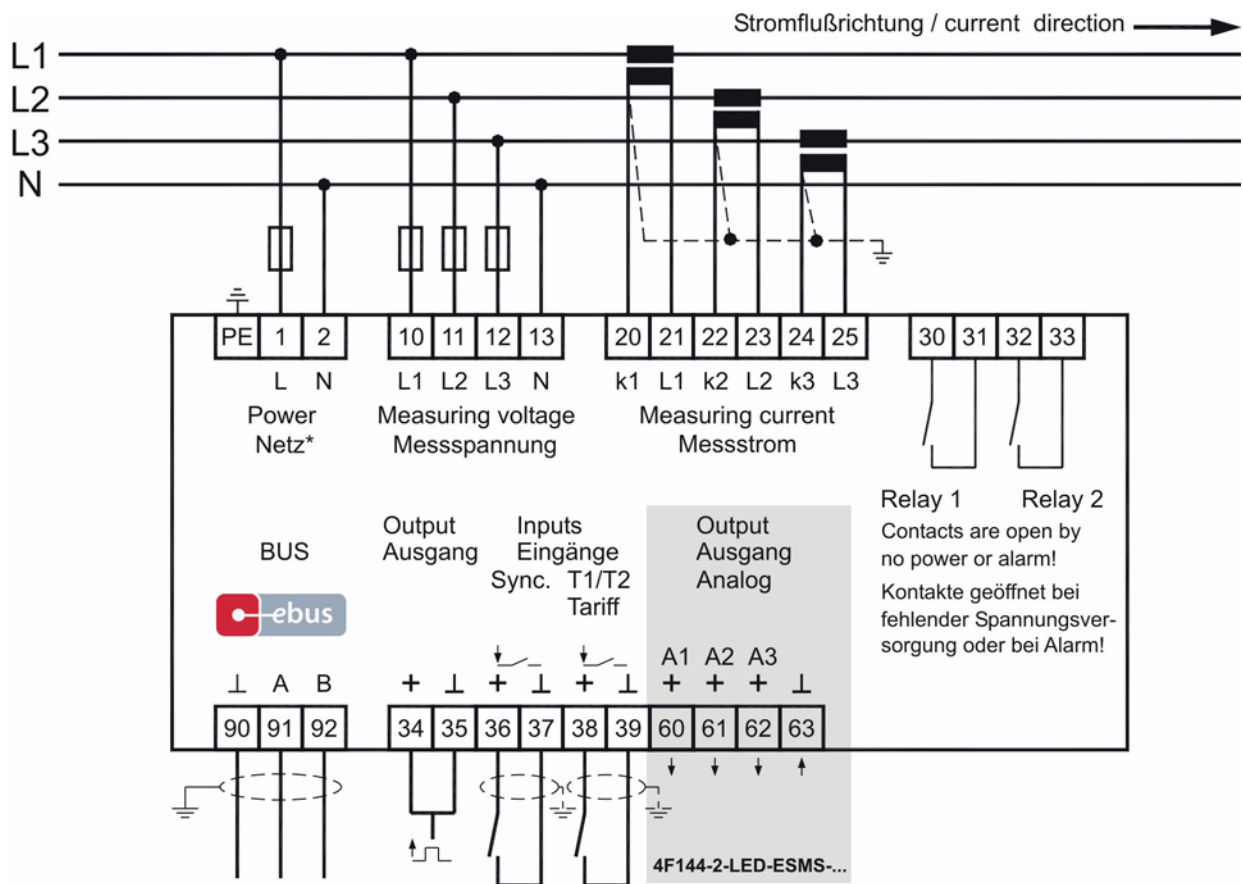
* For supply voltage, see nameplate.

4.3 Terminal assignment

Terminal	1 (L) and 2 (N):	Connection power supply
		A control voltage is required to supply the device with power. The unit is equipped with a multirange power supply and may be supplied by voltages from 85 - 265V AC/DC or 20 - 70V AC/DC (see nameplate for device voltage).

Terminal	10 (L1):	Measuring input for voltage
	11 (L2)	Three-phase voltage measurement in three-wire as well as four-wire rotary current networks. Direct measurement for 3x 5...100...120V or 3x20...500...600V AC. Measuring intervals are programmable. Exceeding the measuring interval results in an error message. For higher voltages, the unit needs to be connected via a voltage transformer.
	12 (L3)	
	13 (N)	

Terminal	20 (k1) and 21 (l1):	Current measuring inputs
	22 (k2) and 23 (l2)	The measuring inputs for current must be connected via x/1A AC or x/5A AC current transformers.
	24 (k3) and 25 (l3)	When connecting transformers, pay attention to the energy flow direction and to the correct assignment of measurement voltage inputs to current transformers.

Terminals 30 and 31:		**Floating relay contact relay 1**

This contact serves as a message or alarm output. During operation, an acoustic or visual signal may be activated or a consumer shut down. The contact is open as long as the device is currentless, and if there is an active message. Maximum switching capacity of 2A at 250V AC.

Terminals 32 and 33:   **Floating relay contact relay 2**

Refer to the description of the floating relay contact relay 1

Terminal   90 (ground)   **Interface connection**

  91 (A)   For communication at the Energy Bus

  92 (B):

Terminal   34 (+) and 35 (-):   **Pulse output**

Output of energy-proportional pulses via a digital contact (S_0 interface in accordance with DIN 43864). Correct polarity is important for this output. The output signals can be processed by a maximum demand monitor or a master central process control, for example.

Terminals 36 and 37:   **Synchronization input**

A floating contact, e.g. from the energy supplier for synchronizing the measuring period, can be connected to this input.

Terminals 38 (-) and 39 (+):   **Tariff input**

A floating contact, e.g. from the energy supplier for switching from high to low tariff, can be connected to this input.

Terminals 60, 61, 62 and 63:   **Analog outputs**

At these outputs, different parameters can be output as analog values either between 0-20mA or 4-20mA or 0-10 Volt or 2-10 Volt.
Depending on which quantity should be output, you can assign it for a certain phase (L1, L2, L3) or for its total value to the analog output.

4.4   Control and display panel
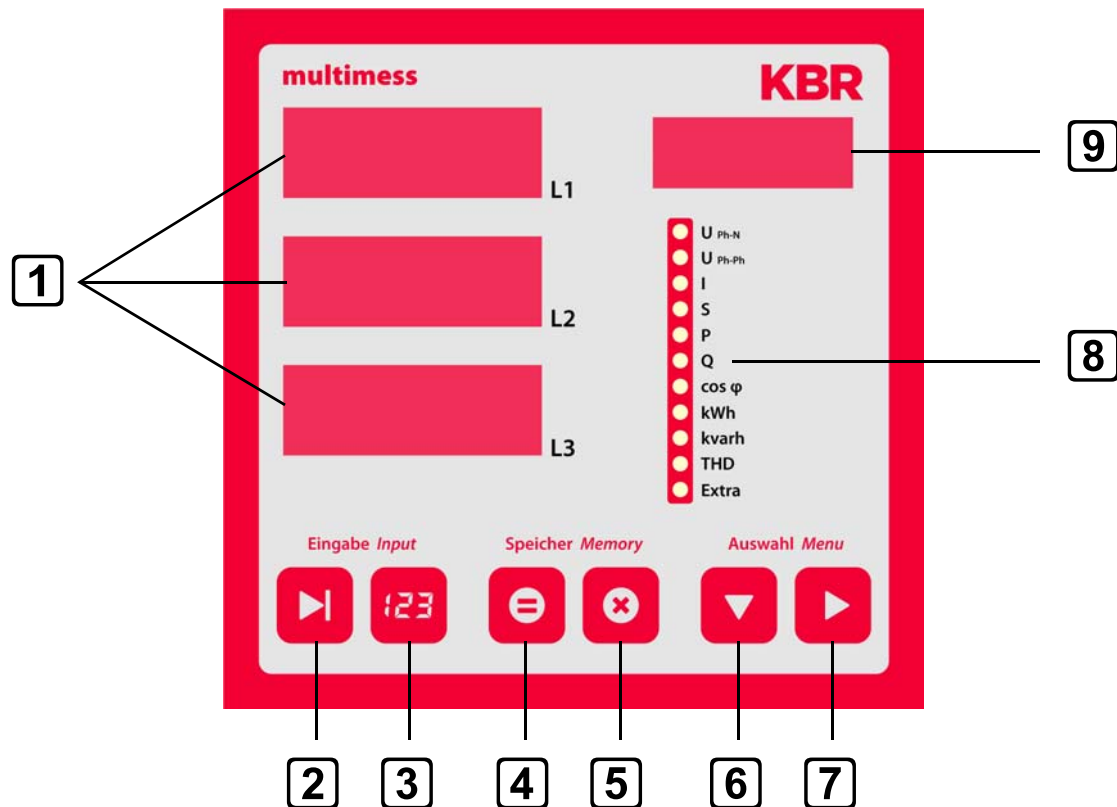
4.4.1   Description of sensor buttons and displays

1	230	L1	Three four-digit 7-segment displays for displaying measured, stored and programmed values (3-phase; L1-L2-L3)
	230	L2	
	230	L3	

2 ▶| Starts the programming mode and switches between the places to be edited to **1** and **9**. Programmable places are shown flashing.

3 123   In the programming mode, this changes the flashing value to **1** or the decimal point to **1** and the prefix of units to **9**.

4 ⊖   Display for saved minimum and maximum values.
In the programming mode, this enables saving the parameters or values entered.

5 ⊗   Deletes the memory values displayed with ⊖ , such as extreme values, energy etc.
In the programming mode, you can use this button to cancel programming without applying any changes.

| 6 ▼ | Selects one of the 11 main menus or jumps back from a submenu to the current main menu item. Keep the key depressed to switch between the individual main menus automatically.
In the programming mode, you can use this button to switch between the input fields L1, L2 and L3. |
| --- | --- |
| 7 ▶ | Jumps to the corresponding submenus. |
| 8 ⡇ | 11 green LEDs indicate the main menus.
A permanent LED indicates the currently selected menu.
If an LED is flashing this indicates a limit violation in the corresponding menu. The LED does not flash, however, if the limit violation occurred in the menu currently displayed. |
| 9 ⸢ A ⸥ | The 4-digit 15-segment display for displaying information and dimensions of the values displayed in 1 .
When reading the saved extreme values, the display switches between the unit and the display MIN for minimum value or MAX for maximum value. This principle applies to other menus as well and will be described in the corresponding sections in this manual. |

5   Operation

5.1   Menu structure of multimess 4F144-2-LED-ESMS-...

▼
- Switches between the main menus.
- They are indicated by a permanent LED.
- Keep the key depressed to switch between the individual main menus automatically.
- Press this key in a submenu to switch back to the corresponding main menu without applying any changes.

▶
- Switches to the desired submenu.
- Press this key to switch from the last submenu back to the corresponding main menu.

5.2   Navigation and device displays
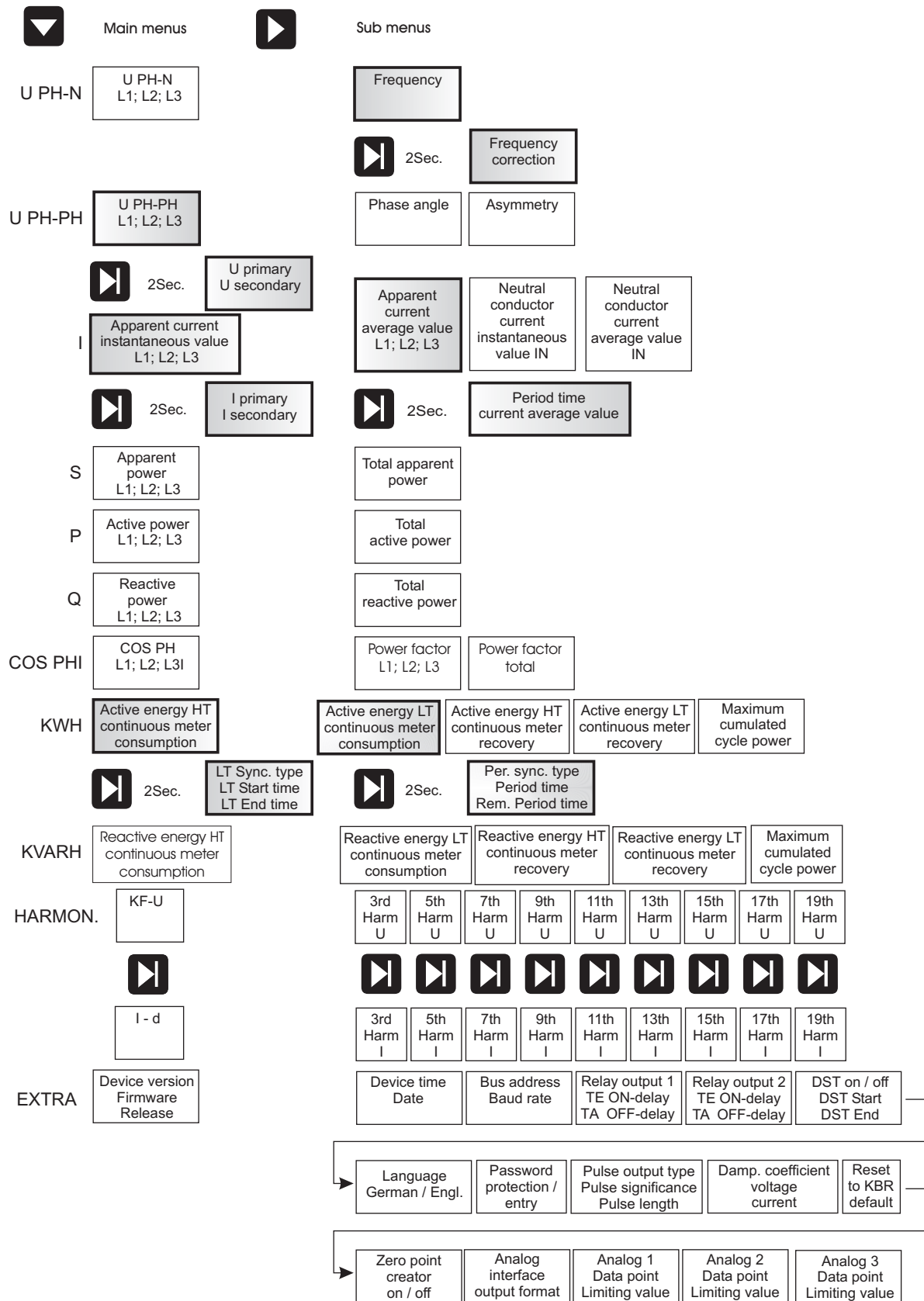
6   Setting parameters

6.1   General programming scheme

The programming scheme below applies to all parameters to be programmed in each menu.

▶|	• Press this button for 2 seconds to switch into the programming mode from a main menu or submenu. The set parameters are displayed. • Press this button again to activate the parameter input mode. • This button is also used for switching from one place to the next when entering values.
123	• Value input.
▼	• In the programming mode, press this button to switch between the input fields L1, L2 and L3. • It also serves to return to the main menu after saving changes or cancelling the programming mode.
⊜	• This button is used to save changes.
⊗	• Press this button if you want to cancel the programming mode without applying any changes.
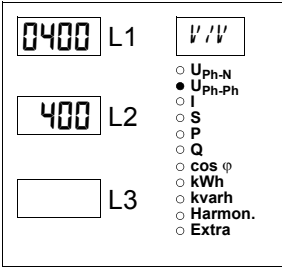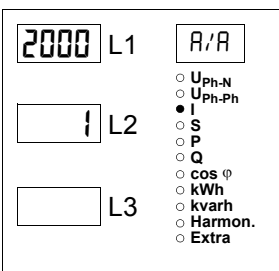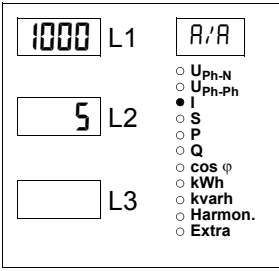
6.2   U $_{Ph-Ph}$ - Measuring reference voltage / rated power voltage

Menu	Key combination	Device display	Description
Main menu U$_{Ph-Ph}$ Submenu Set voltage transformer ratio	▶| Keep button depressed for 2 seconds ▶| Input mode	`0400` L1 `V /V` ○ U$_{Ph-N}$ ● U$_{Ph-Ph}$ ○ I `400` L2 ○ S ○ P ○ Q ○ cos φ `     ` L3 ○ kWh ○ kvarh ○ Harmon. ○ Extra	When you call up the menu, the following text will be displayed in the unit display: *VOLTAGE TRANSFORMER RATIO UPRI / USEC V / V* The display L1 shows the primary voltage. Display L2 displays the secondary voltage.

Menu	Key combination	Device display	Description
Submenu Set primary-voltage transformer ratio	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	`0400` L1 `V/V` ○ U_{Ph-N} ● U_{Ph-Ph} ○ I `400` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	The first digit is flashing in display L1. Press the button 🔢 to set the value of this digit. Press the button ▶ to switch to the next digit. If all digits have been set, the display L1 will be flashing. To move the decimal point, press the button 🔢.
Main menu U_{Ph-Ph}	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Set secondary voltage transformer ratio	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	`0400` L1 `V/V` ○ U_{Ph-N} ● U_{Ph-Ph} ○ I `400` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	The first digit is flashing in display L2. Press the button 🔢 to set the value of this digit. Press the button ▶ to switch to the next digit. Values between 1V and 600V are permissible.
Main menu U_{Ph-Ph}	▶ or ▼		
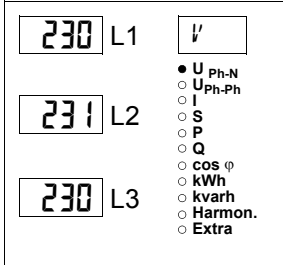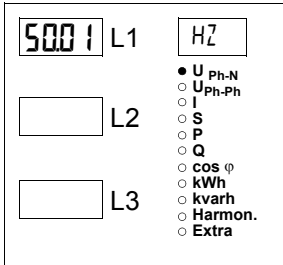
6.3 I - Current transformer transfer ratio

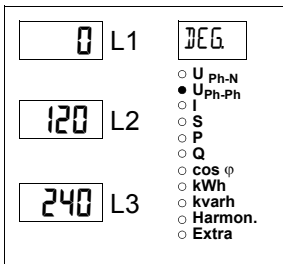| Menu	Key combination	Device display	Description
Main menu I			
Submenu Set current transformer ratio	▶ Keep button depressed for 2 seconds ▶ Input mode	`1000` L1 `A/A` ○ U_{Ph-N} ○ U_{Ph-Ph} ● I `1` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	When you call up the menu, the following text will be displayed in the unit display: A/A CURRENT TRANSFORMER RATIO IPRI / ISEC A / A The display L1 shows the primary current. Display L2 displays the secondary current.
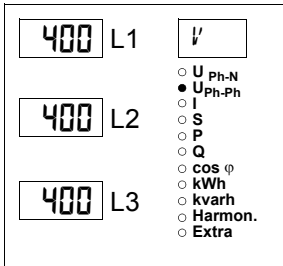
Menu	Key combination	Device display	Description
Submenu Set primary current transformer ratio	🔢 ..... ⏭ next digit or ❌ cancel or ⊖ save	2000 L1 A/A ○ U_{Ph-N} ○ U_{Ph-Ph} ● I 1 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	The first digit is flashing in display L1. Press the button 🔢 to set the value of this digit. Press the button ⏭ to switch to the next digit. If all digits have been set, the display L1 will be flashing. To move the decimal point, press the button 🔢.
Main menu I	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Set secondary current transformer ratio	🔢 ..... ⏭ next digit or ❌ cancel or ⊖ save	1000 L1 A/A ○ U_{Ph-N} ○ U_{Ph-Ph} ● I 5 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	The first digit is flashing in display L2. Press 🔢 to switch between 1A and 5A.
Main menu I	▶ or ▼		
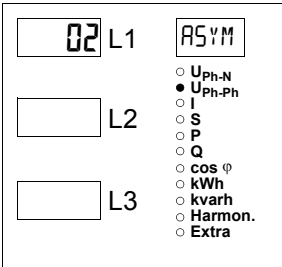
7   Display functions

7.1   U$_{Ph-N}$ - Voltage phase to neutral conductor, frequency
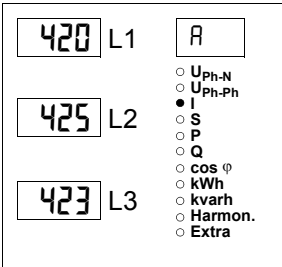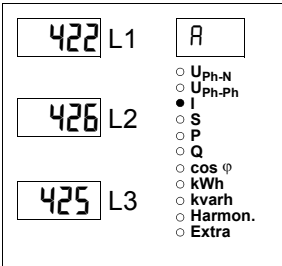
Menu	Key combination	Device display	Description
Main menu U $_{Ph-N}$		230 L1 V • U $_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I 231 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 230 L3 ○ kvarh ○ Harmon. ○ Extra	Displays the three phase voltages U$_{L1-N}$, U$_{L2-N}$ and U$_{L3-N}$ in the displays L1 to L3. The unit display shows the unit for the voltage. The device switches from V to KV automatically.
	▶ next		
Submenu Frequency		50.01 L1 HZ • U $_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	Shows the instantaneous frequency in the display L1.
Main menu U $_{Ph-N}$	▶ or ▼		

7.2   U$_{Ph-Ph}$ - Voltage phase to phase, rotary field display

Menu	Key combination	Device display	Description
	▼		
Main menu U$_{Ph-Ph}$		400 L1 V ○ U $_{Ph-N}$ • U$_{Ph-Ph}$ ○ I 400 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 400 L3 ○ kvarh ○ Harmon. ○ Extra	The three phase-to-phase voltages U$_{L1-L2}$, U$_{L2-L3}$ and U$_{L3-L1}$ are shown in the displays L1 to L3. The unit display shows the unit for the voltage. The device switches from V to KV automatically.
	▶ next		
Submenu Rotary field		0 L1 DEG ○ U $_{Ph-N}$ • U$_{Ph-Ph}$ ○ I 120 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 240 L3 ○ kvarh ○ Harmon. ○ Extra	Displays the three rotary field angles of the voltages in relation to each other. The unit display shows the unit "DEG".
Submenu Asymmetry	▶ next		

Menu	Key combination	Device display	Description
Submenu Asymmetry			Display of voltage asymmetry according to standard EN6100-4-30:2003
		☐☐ L1 ⎡ᴀꜱʏᴍ⎤	Shows the asymmetric load of the three-phase network.
		○ U_Ph-N ● U_Ph-Ph ○ I	The unit display switches between ᴀꜱʏᴍ and ᵒ/ᴏ.
		L2 ○ S ○ P ○ Q	
Main menu U _Ph-Ph_	▶ or ▼	L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	
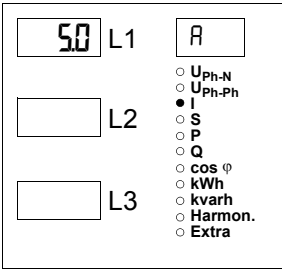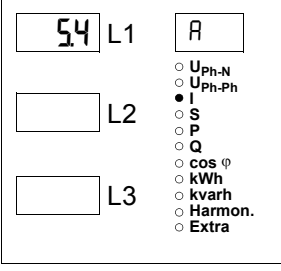
7.3   I /IN – Current / neutral conductor current, instantaneous – average value switch-over

Menu	Key combination	Device display	Description
	▼		
Main menu I Instantaneous value		⎡420⎤ L1 ⎡ A ⎤	Displays the three conductor currents in the phases L1, L2 and L3.
		○ U_Ph-N ○ U_Ph-Ph ● I	The values displayed are instantaneous values.
		⎡425⎤ L2 ○ S ○ P ○ Q	The unit display switches between ᴀᴄᴛ and ᴀ.
	▶ next	⎡423⎤ L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	
Submenu I Average value	▶ next or	⎡422⎤ L1 ⎡ A ⎤	Displays the three conductor currents in the phases L1, L2 and L3.
		○ U_Ph-N ○ U_Ph-Ph ● I	The values displayed are average values.
	▼ Back to main menu	⎡426⎤ L2 ○ S ○ P ○ Q	The unit display switches between ᴀᴠɢ and ᴀ.
		⎡425⎤ L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	
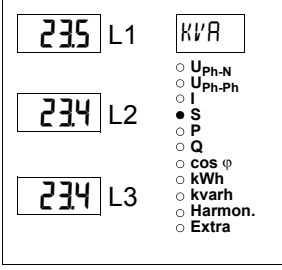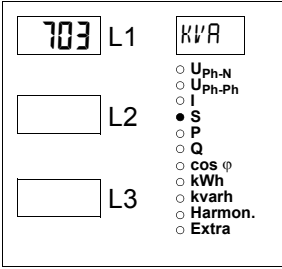
ℹ️ **Note**
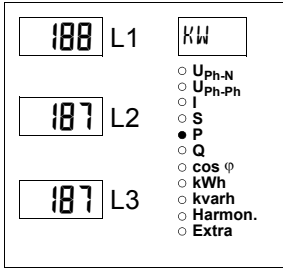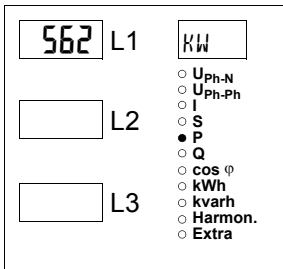
If there is a negative sign in front of the displayed current values, the energy flow direction is negative.
A positive sign indicates energy consumption.
A negative sign indicates energy recovery.

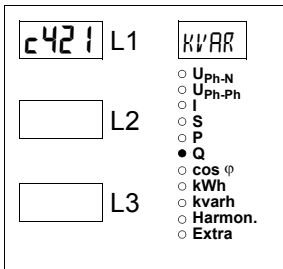| Menu	Key combination	Device display	Description
Submenu I_N Neutral conductor current Instantaneous value	▶ or ▼	5.0 L1 A ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ● I ○ S L2 ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	The display L1 shows the instantaneous neutral conductor current. The unit display switches between NACT and A.
Submenu I_N Neutral conductor current Average value	▶ next or ▼ Back to main menu	5.4 L1 A ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ● I ○ S L2 ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	The display L1 shows the average value of the neutral conductor current. The unit display switches between NAVG and A.
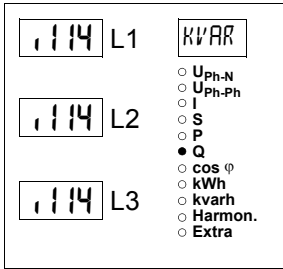
7.4   S – Apparent power / total apparent power

Menu	Key combination	Device display	Description
	▼		
Main menu S Apparent power	▶ next	235 L1 KVA ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I 234 L2 ● S ○ P ○ Q ○ cos φ 234 L3 ○ kWh ○ kvarh ○ Harmon. ○ Extra	Displays the apparent power of the three phases in the displays L1 to L3. The unit display shows the apparent power in KVA. The device switches from VA to KVA or MVA automatically.
Submenu Total apparent power Main menu S Apparent power	▶ or ▼	703 L1 KVA ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I ● S L2 ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	Shows the total apparent power in the display L1. The unit display switches between KVA and STOT. The device switches from VA to KVA or MVA automatically.
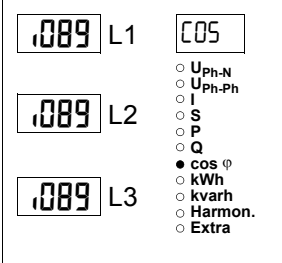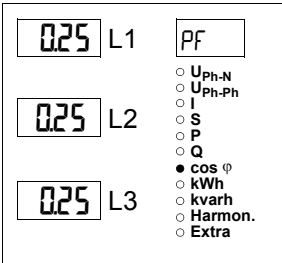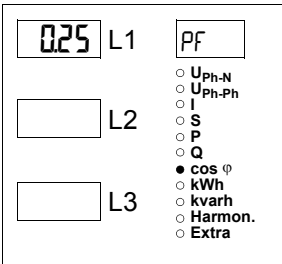
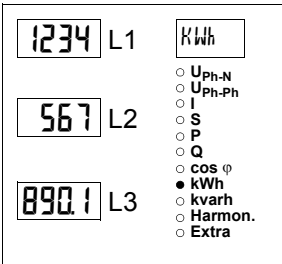## 7.5   P – Active power / total active power

Menu	Key combination	Device display	Description

Menu	Key combination ▼	Device display	Description
Main menu P Active power		`188` L1 `KW` ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ● P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra `187` L2 `187` L3	The active power of the three phases is shown in the displays L1 to L3. The unit display shows the active power in `KW` The device switches from `W` to `KW` or `MW` automatically.
	▶ next		
Submenu Total active power		`562` L1 `KW` ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ● P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra L2 L3	Shows the total active power in the display L1. The unit display switches between `PTOT` and `KW` The device switches from `W` to `KW` or `MW` automatically.
Main menu P Active power	▶ or ▼		

7.6   Q – Reactive power / total reactive power

Menu	Key combination ▼	Device display	Description
Main menu Q Reactive power		`ı114` L1 `KVAR` ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ● Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra `ı114` L2 `ı114` L3	The reactive power of the three phases is shown in the displays L1 to L3. An " ı " in front of the value indicates inductive, a "c ", capacitive reactive power. The unit display shows the reactive power in `KVAR`. The device switches from `VAR` to `KVAR` or `MVAR` automatically.
	▶ next		
Submenu Total reactive power		`c421` L1 `KVAR` ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ● Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra L2 L3	Shows the total reactive power in the display L1. An " ı " in front of the value indicates inductive, a "c ", capacitive reactive power. The unit display switches between `QTOT` and `KVAR`. The device switches from `VAR` to `KVAR` or `MVAR` automatically.
Main menu Q Reactive power	▶ or ▼		

7.7 Cos φ - First harmonic power factor, PF, cumulated PF
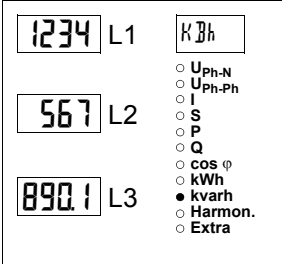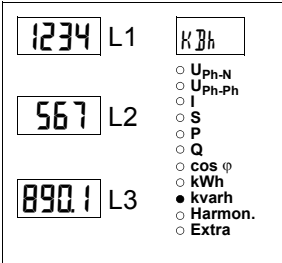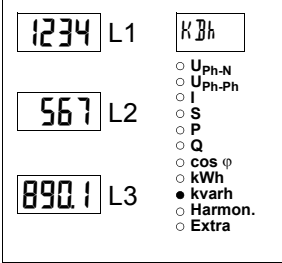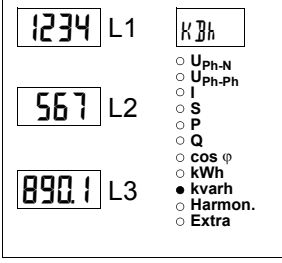
Menu	Key combination ▼	Device display	Description
Main menu cosφ	▶ next	.089 L1 COS ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ● cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra .089 L2 .089 L3	Display of cos φ. Display L1 shows the cos φ for the phase L1. (ı inductive, c capacitive) Display L2 shows the cos φ for the phase L2. (ı inductive, c capacitive) Display L3 shows the cos φ for the phase L3. (ı inductive, c capacitive) The unit display shows COS. (The cos φ displayed refers to the fundamental wave)
Submenu PF	▶ next or ▼ Back to main menu	0.25 L1 PF ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ● cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra 0.25 L2 0.25 L3	Display of the power factor PF. Display L1 shows the power factor 1 for the phase L1. Display L2 shows the power factor 2 for the phase L2. Display L3 shows the power factor 3 for the phase L3. The unit display shows PF.
Submenu Total LF Main menu COS φ	▶ or ▼	0.25 L1 PF ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ● cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra L2 L3	Displays the cumulated power factor. The display L1 shows the cumulated power factor. The unit display switches between TOT and PF.
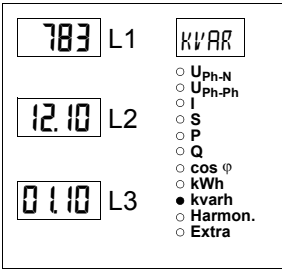
7.8 kWh – Active energy HT/LT consumption and recovery, maximum cumulated active energy of the period

Menu	Key combination ▼	Device display	Description
Main menu kWh Active energy high tariff Consumption	▶ next	1234 L1 KWh ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ● cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra 567 L2 890.1 L3	Active energy counter for high tariff consumption. The display L3 - L1 shows the value of the continuous energy counter. The unit display switches between HT and KWh. 1234 Display L1 G Wh display 567 Display L2 M Wh display 890.1 Display L3 k Wh display

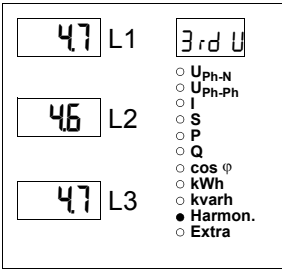| Menu	Key combination	Device display	Description
Submenu kWh Active energy Low tariff Consumption	▶ next or ▼ Back to main menu	`1234` L1 `567` L2 `890.1` L3 — KWh ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	Active energy counter for low tariff consumption. The display L3 - L1 shows the value of the continuous energy counter. The unit display switches between LT and KWh. `1234` Display L1 G Wh display `567` Display L2 M Wh display `890.1` Display L3 k Wh display
Submenu kWh Active energy High tariff Recovery	▶ next or ▼ Back to main menu	`1234` L1 `567` L2 `890.1` L3 — KWh ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	Active energy counter for high tariff recovery. The display L3 - L1 shows the value of the continuous energy counter. The unit display switches between HT- and KWh. `1234` Display L1 G Wh display `567` Display L2 M Wh display `890.1` Display L3 k Wh display
Submenu kWh Active energy Low tariff Recovery	▶ next or ▼ Back to main menu	`1234` L1 `567` L2 `890.1` L3 — KWh ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	Active energy counter for low tariff recovery. The display L3 - L1 shows the value of the continuous energy counter. The unit display switches between LT- and KWh. `1234` Display L1 G Wh display `567` Display L2 M Wh display `890.1` Display L3 k Wh display
Submenu Pcum-max Maximum cumulated cycle power		`783` L1 `12.10` L2 `01.10` L3 — KW ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	When you call up the menu, the following text will be displayed in the unit display: PCMX MAXIMUM CUMULATED POWER IN PERIOD. Then the display switches between PCMX and KW The display L1 shows the period value. The display L2 shows the exact time the maximum occurred (hh:mm). The display L3 shows day and month, alternately with the year of the maximum (dd.mm.yyyy).
Main menu kWh	▶ or ▼		

7.9 kvarh - Reactive energy counter HT/LT consumption and recovery, maximum cumulated cycle reactive power
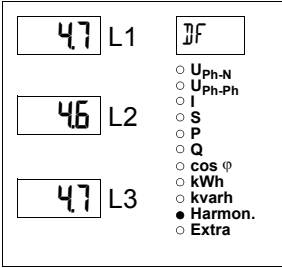
Menu	Key combination ▼	Device display	Description
Main menu kvarh Reactive energy high tariff Consumption	▶ next	`1234` L1 `567` L2 `890.1` L3 `KJh` ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ● kvarh ○ Harmon. ○ Extra	Reactive energy counter for high tariff consumption. The display L3 - L1 shows the value of the continuous reactive energy counter. The unit display switches between HT and KJh. 1234 Display L1 G varh display 567 Display L2 M varh display 890.1 Display L3 k varh display
Submenu kvarh Reactive energy low tariff consumption	▶ next or ▼ Back to main menu	`1234` L1 `567` L2 `890.1` L3 `KJh` ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ● kvarh ○ Harmon. ○ Extra	Reactive energy counter for low tariff consumption. The display L3 - L1 shows the value of the continuous reactive energy counter. The unit display switches between LT and KJh. 1234 Display L1 G varh display 567 Display L2 M varh display 890.1 Display L3 k varh display
Submenu kvarh Reactive energy high tariff recovery	▶ next or ▼ Back to main menu	`1234` L1 `567` L2 `890.1` L3 `KJh` ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ● kvarh ○ Harmon. ○ Extra	Reactive energy counter for high tariff recovery. The display L3 - L1 shows the value of the continuous reactive energy counter. The unit display switches between $HT-$ and KJh. 1234 Display L1 G varh display 567 Display L2 M varh display 890.1 Display L3 k varh display
Submenu kvarh Reactive energy low tariff recovery	▶ next or ▼ Back to main menu	`1234` L1 `567` L2 `890.1` L3 `KJh` ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ● kvarh ○ Harmon. ○ Extra	Reactive energy counter for low tariff recovery. The display L3 - L1 shows the value of the continuous reactive energy counter. The unit display switches between $LT-$ and KJh. 1234 Display L1 G varh display 567 Display L2 M varh display 890.1 Display L3 k varh display

Menu	Key combination	Device display	Description
Submenu Qcum-max Maximum cumulated cycle power			When you call up the menu, the following text will be displayed in the unit display: QCMX MAXIMUM CUMULATED POWER IN PERIOD. Then the display switches between QPCMX and KVAR. The display L1 shows the period value. The display L2 shows the exact time the maximum occurred (hh:mm). The display L3 shows day and month, alternately with the year of the maximum (dd.mm.yyyy).
Main menu kvarh	▶ or ▼		

ℹ Note

The daily energy counters (active and reactive) of the unit may only be read out via the KBR Energy Bus by means of an optionally available software.

7.10 Harmon. - Distortion factor and partial oscillation of the network harmonics for voltage and current

Menu	Key combination	Device display	Description
	▼		
Main menu Harmon. Voltage Distortion factor	▶ next or ▶❘ Switch to current harmonics or ▼ Back to main menu		The display L1 shows the distortion factor in % for the voltage of phase L1. The display L2 shows the distortion factor in % for the voltage of phase L2. The display L3 shows the distortion factor in % for the voltage of phase L3. The unit display switches between DF and %.
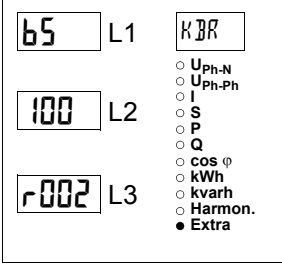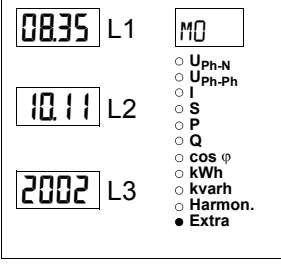
Menu	Key combination	Device display	Description
Submenu 3rd to 19th harmonic			Displays the 3rd harmonics. The display L1 shows the 3rd harmonic in % for the voltage of phase L1. The display L2 shows the 3rd harmonic in % for the voltage of phase L2. The display L3 shows the 3rd harmonic in % for the voltage of phase L3. The unit display switches between $3rd$ U and $°/o$. The following harmonics (5th – 19th) are displayed in the same way. When displaying the current harmonic, the display for example switches between $3rd$ I and A, when displaying the distortion current intensity, between Id and A.
	▶ next or ▷▏ Switch to current harmonics or ▼ Back to main menu	[Display: 4.7 L1 / 3rd U; 4.6 L2; 4.7 L3 — Harmon. indicator]	
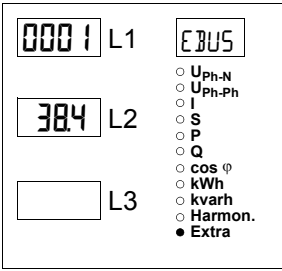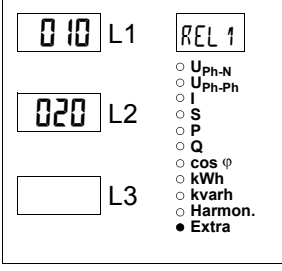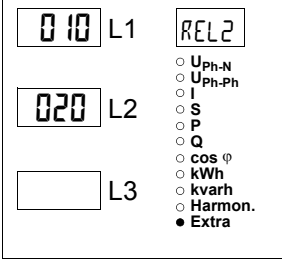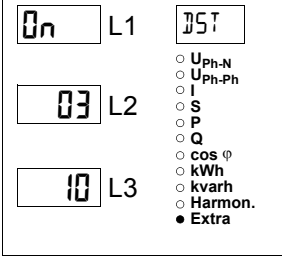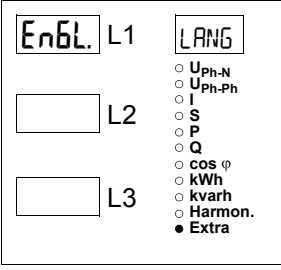
ⓘ **Note**
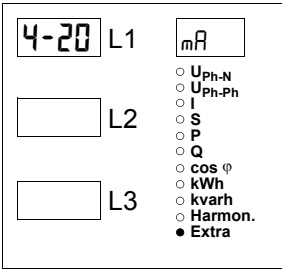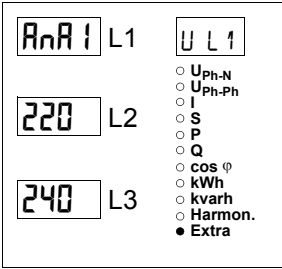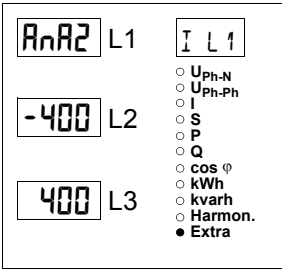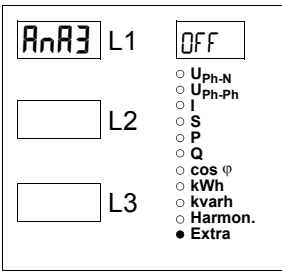
Use the button ▷▏ to switch between the voltage harmonic and the current harmonic at any position in the menu.
The current harmonics are displayed in amperes.

7.11 Extra

Menu	Key combination	Device display	Description
	▼		
Main menu Extra		[Display: b5 L1 / KBR; 100 L2; r002 L3 — Extra indicator]	The display L1 shows the device type (here: Basic). The display L2 shows the version number. The display L3 shows the release number. The device information is shown in the unit display.
	▶ next		
Submenu Date and time	▶ next or	[Display: 08.35 L1 / MO; 10.11 L2; 2002 L3 — Extra indicator]	The display L1 shows the time (hh.mm). The display L2 shows the date (dd.mm). The display L3 shows the year (yyyy). The unit display shows the day of the week.
	▼ Back to main menu		
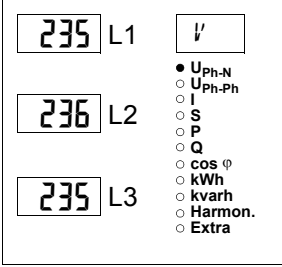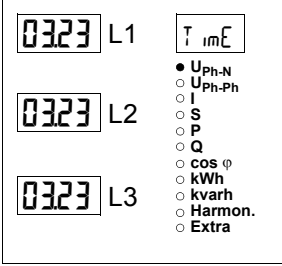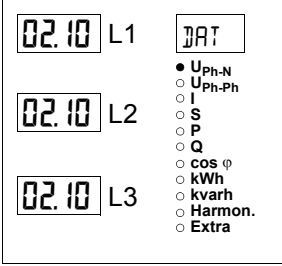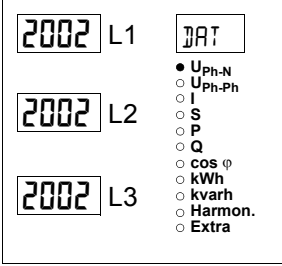
Menu	Key combination	Device display	Description
Submenu E Bus	▶ next or ▼ Back to main menu	`0001` L1 `EBUS` ○ U_Ph-N ○ U_Ph-Ph ○ I `38.4` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The display L1 shows the device address. The baud rate is displayed in display L2. The unit display shows EBUS.
Submenu REL 1	▶ next or ▼ Back to main menu	`010` L1 `REL 1` ○ U_Ph-N ○ U_Ph-Ph ○ I `020` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The display L1 shows the on-delay for relay 1 in seconds. The display L2 shows the off-delay for relay 1 in seconds. The unit display switches between REL 1 and tON.
Submenu REL 2	▶ next or ▼ Back to main menu	`010` L1 `REL2` ○ U_Ph-N ○ U_Ph-Ph ○ I `020` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The display L1 shows the on-delay for relay 2 in seconds. The display L2 shows the off-delay for relay 2 in seconds. The unit display switches between REL2 and tON.
Submenu Daylight saving time	▶ next or ▼ Back to main menu	`On` L1 `DST` ○ U_Ph-N ○ U_Ph-Ph ○ I `03` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `10` L3 ○ kvarh ○ Harmon. ● Extra	The display L1 indicates whether daylight saving time is activated or not. The display L2 shows the month daylight saving time begins. The display L3 shows the month daylight saving time ends. The unit display shows DaYLiGhT SavinG and then DST.
Submenu Language	▶ next or ▼ Back to main menu	`EnGL.` L1 `LANG` ○ U_Ph-N ○ U_Ph-Ph ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The display L1 shows the user language. For German, it displays dEUt For English, EnGL The unit display shows SPRA when the user language is German and LANG for English.

Menu	Key combination	Device display	Description
Submenu Password	▶ next or ▼ Back to main menu	$CodE$ L1 $LOCK$ ---- L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows CODE. The unit display shows $LOCK$ or $FREE$. In L2, the password can be entered (as a 4-digit code). The device is defaulted with the code 9999, i.e. all functions of the device are available.
Submenu Pulse output	▶ next or ▼ Back to main menu	P L1 $IMP:$ 1.000 L2 100 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 indicates whether the pulse output is deactivated (OFF) or configured for active (P) or reactive (Q) energy. The display L2 shows the pulse value, i.e. pulse/kWh or kVARh. The display L3 displays the energy pulse duration in msec.
Submenu Damping factor		$U\ 0$ L1 DF $1\ 0$ L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the damping coefficient for acquiring the voltage. The display L2 shows the damping coefficient for acquiring the current.
Main menu Extra	▶ or ▼		
Submenu Reset to default settings	▶ next or ▼ Back to main menu	L1 $DEF.$ L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The device is reset to the default KBR factory settings. **All stored values are lost.** The unit display shows $DEFAULT$ $PARAMETER$ and then $DEF.$
Submenu Zero-point creator	▶ next or ▼ Back to main menu	OFF L1 $0-P$ L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	If the zero-point creator is deactivated, display L1 shows OFF. If the zero-point creator is activated, it shows ON. The unit display shows $ZEro-PoinT$ $crEaTor$ and then $0-P.$

Menu	Key combination	Device display	Description
Submenu analog interfaces	▶ next or ▼ Back to main menu	`4-20` L1 `mA` ○ U_{Ph-N} ○ U_{Ph-Ph} L2 ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 and the unit display show the output type. Available are: 0-20 mA, 4-20 mA, 0-10 V and 2-10 V, valid for all 3 outputs. In the unit display, ANALOG TYPE is displayed, followed by mA or V.
Submenu Analog 1 Data points Limits	▶ next or ▼ Back to main menu	`AnA 1` L1 `U L1` ○ U_{Ph-N} ○ U_{Ph-Ph} `220` L2 ○ I ○ S ○ P ○ Q `240` L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the instantaneous analog interface. Display L2 shows the lower limit, display L3 the upper limit. The unit display shows the parameter to be output.
Submenu Analog 2 Data points Limits	▶ next or ▼ Back to main menu	`AnA2` L1 `I L1` ○ U_{Ph-N} ○ U_{Ph-Ph} `-400` L2 ○ I ○ S ○ P ○ Q `400` L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the instantaneous analog interface. Display L2 shows the lower limit, display L3 the upper limit. For current and active power, positive and negative values (sign in front of value) can be configured. The unit display shows the parameter to be output.
Submenu Analog 3 Data points Limits Main menu Extra	▶ or ▼	`AnA3` L1 `OFF` ○ U_{Ph-N} ○ U_{Ph-Ph} L2 ○ I ○ S ○ P ○ Q L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the instantaneous analog interface. Display L2 shows the lower limit, display L3 the upper limit. The unit display shows the parameter to be output.

7.12 Maximum / Minimum values display

The following section explains how to display the extreme values; the maximum and minimum values of the phase-to-neutral voltages serve as an example.

Menu	Key combination	Device display	Description
Main menu U_{Ph-N} Maximum voltage	▶ next or ▼ Back to main menu	`235` L1 `V` ● U_{Ph-N} ○ U_{Ph-Ph} ○ I `236` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `235` L3 ○ kvarh ○ Harmon. ○ Extra	The maximum values that occurred for the phase voltages are displayed in the displays L1 to L3 for each phase. The unit display switches between MAX and V.
Maximum voltage	▶ next or ▼ Back to main menu	`03.23` L1 `TimE` ● U_{Ph-N} ○ U_{Ph-Ph} ○ I `03.23` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `03.23` L3 ○ kvarh ○ Harmon. ○ Extra	The time the maximum values occurred for the phase voltages are displayed in the displays L1 to L3. The unit display switches between MAX and TIME.
Maximum voltage	▶ next or ▼ Back to main menu	`02.10` L1 `DAT` ● U_{Ph-N} ○ U_{Ph-Ph} ○ I `02.10` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `02.10` L3 ○ kvarh ○ Harmon. ○ Extra	The day the maximum values occurred for the phase voltages are displayed in the displays L1 to L3. The unit display switches between MAX and DAT.
Maximum voltage Main menu U_{Ph-N}	 ▶ or ▼	`2002` L1 `DAT` ● U_{Ph-N} ○ U_{Ph-Ph} ○ I `2002` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `2002` L3 ○ kvarh ○ Harmon. ○ Extra	The year the maximum values occurred for the phase voltages are displayed in the displays L1 to L3. The unit display switches between MAX and DAT.

ⓘ Note

> **Use the button ⊖ to switch from maximum to minimum values at any position in the menu. Operation for reading the minimum values corresponds to reading the maximum values.**
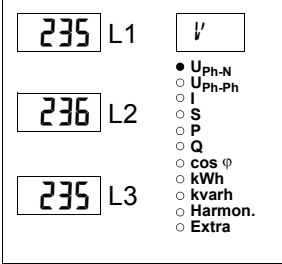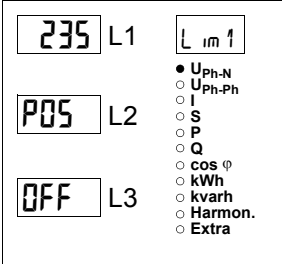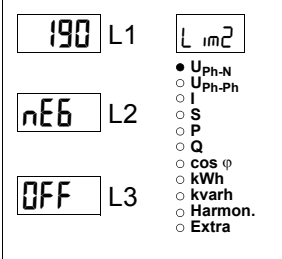
The following table gives an overview of all extreme values stored in **multimess 4F144-2-LED-ESMS-...**.

Stored extreme values with date and time they occurred.

Menu	Measured quantity	Stored extreme values	Text output in German and English
Main menu U $_{Ph-N}$	Phase-to-neutral voltage	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu F $_{Power}$	Power frequency	Minimum and maximum value for L1 with date and time	Min and Max
Main menu U $_{Ph-Ph}$	Phase-to-phase voltage	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Main menu I $_{ACT}$	Phase current Instantaneous values	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu I $_{AVRG}$	Average values for phase current	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu I $_{NACT}$	Instantaneous value of neutral conductor current	Minimum and maximum value for neutral conductor current with date and time	Min and Max
Submenu I $_{NAVG}$	Neutral conductor current Average value	Minimum and maximum value for neutral conductor current average value with date	Min and Max
Main menu S	Apparent power	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu S $_{TOT}$	Total apparent power	Minimum and maximum value for total apparent power with date and time	Min and Max
Main menu P	Active power	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu P $_{TOT}$	Total active power	Minimum and maximum value for total apparent power with date and time	Min and Max
Main menu Q	Reactive power	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu Q $_{TOT}$	Total reactive power	Minimum and maximum value for total reactive power with date and time	Min and Max
Main menu COS φ	Fundamental power factor	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu PF	Power factor	Minimum and maximum value for L1 - L2 - L3 with date and time	Min and Max
Submenu Total PF	Cumulated power factor	Minimum and maximum value for total power factor with date and time	Min and Max
Main menu Harmon.	Harmonics Harmonics	Maximum values of the voltage distortion factor and the 3rd to 19th harmonics, as well as the current harmonic contents and their sum; L1-L3	Max

7.13 Display limits

The following section explains how to display the limits; limits 1 and 2 of the phase-to-neutral voltage serve as an example.

Menu	Key combination	Device display	Description
Main menu U Ph-N Submenu Maximum voltage	⊖ ▶| Keep buttons depressed for 2 seconds	`235` L1 `V` • U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra `236` L2 `235` L3	The maximum values that occurred for the phase voltages are displayed in the displays L1 to L3 for each phase. The unit display switches between MAX and V.
Submenu Limit 1	▶ on to limit 2 or ▼ Back to main menu	`235` L1 `L im1` • U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra `POS` L2 `OFF` L3	The display L1 shows the limit value. The display L2 shows the effective direction of the limit value. (Limit active if POS is exceeded or NEG is underrun or locked OFF.) The display L3 shows the message type for the limit: OFF message only via KBR Energy Bus: rEL1 additional message at relay 1 rEL2 additional message at relay 2 A limit violation is indicated by a flashing LED in the respective main menu.
Submenu Limit 2	▶ on to limit 1 or ▼ Back to main menu	`190` L1 `L im2` • U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra `nEG` L2 `OFF` L3	Corresponds to limit 1

ⓘ Note

If a relay is not configured as alarm relay, but as switching relay (setting only possible via E Bus), L3 does not display anything.
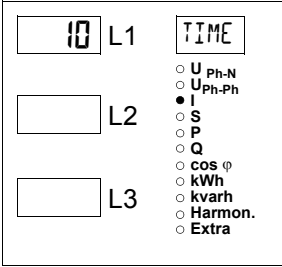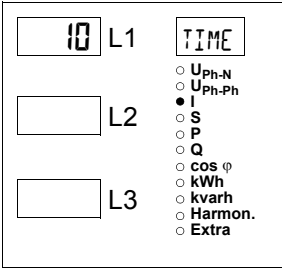
The following table gives an overview of all limits available in the **multimess 4F144-2-LED-ESMS-...**.

Programmed limits.
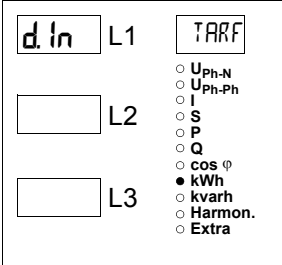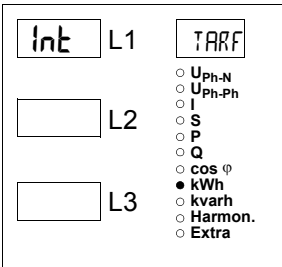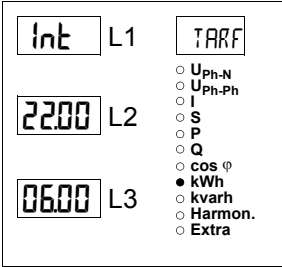
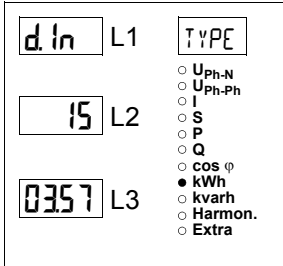| Menu	Measured quantity	Programmed limits	Text output in German and English
Main menu U Ph-N	Phase-to-neutral voltage	Limit 1 and limit 2 L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu F Power	Power frequency	Limit 1 and limit 2	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu U Ph-Ph	Phase-to-phase voltage	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu I ACT	Phase current Instantaneous values	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu I AVRG	Phase current Average values	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu I NACT	Neutral conductor current Instantaneous value	Limit 1 and limit 2 for Instantaneous value of neutral	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu I NAVG	Neutral conductor current Average value	Limit 1 and limit 2 for neutral conductor current average	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu S	Apparent power	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu S TOT	Total apparent power	Limit 1 and limit 2 for Total apparent power	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu P	Active power	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu P TOT	Total active power	Limit 1 and limit 2 for Total active power	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu Q	Reactive power	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu Q TOT	Total reactive power	Limit 1 and limit 2 for Total reactive power	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu COS φ	Fundamental power factor	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu PF	Power factor	Limit 1 and limit 2 for L1 - L2 - L3	Lim 1 and Lim 2 Lim 1 and Lim 2
Submenu Total PF	Cumulated power factor	Limit 1 and limit 2 for Cumulated power factor	Lim 1 and Lim 2 Lim 1 and Lim 2
Main menu Harmon.	Harmonics	Limit 1 and 2 of the distortion factor of the voltage and the 3rd to 19th network harmonics for L1-L3 as well as the current harmonic contents and their sum L1-L3	Lim 1 and Lim 2 Lim 1 and Lim 2

8 Programming
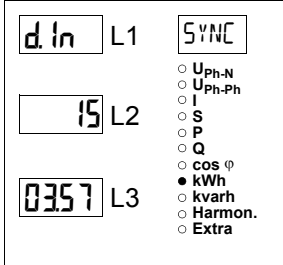
8.1 Period time for average current value

Menu	Key combination	Device display	Description
Main menu I _{ACT} Submenu I Average value	▶❙ Keep buttons depressed for 2 seconds		When you call up the menu, the following text will be displayed in the unit display: *TIME AVERAGE CURRENT* The display L1 displays the period time in minutes.
Period time	▶❙ Start input mode		
Submenu I Average value Set period time	123 ..... ▶❙ next digit or ✕ cancel or ⊖ save		The first digit is flashing in display L1. Press the button 123 to set the value of this digit. Press the button ▶❙ to switch to the next digit. Settings between 1 and 15 minutes are possible.
Main menu I _{ACT}	▶ or ▼		

The device display shows:
- L1: 10, with TIME indicator
- Indicators: U Ph-N, U Ph-Ph, • I, S, P, Q, cos φ, kWh, kvarh, Harmon., Extra
- L2
- L3

8.2 Tariff switching method

Menu	Key combination	Device display	Description
Main menu kWh /HT Submenu Tariff input Tariff switching method	▶❙ Keep buttons depressed for 2 seconds ▶❙ Start input mode	d.In L1 TARF L2 L3 ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	When you call up the menu, the following text will be displayed in the unit display: TARF LT TARIFF TIMES Display L1 displays the tariff switching method. The following switching methods can be selected: - d.In by external pulse - bUS via Energy Bus command - Int by internal time program
Submenu Tariff input Set tariff switching method Main menu kWh	🔢 next mode ▶❙ next digit or ⊜ save ▶ or ▼	Int L1 TARF L2 L3 ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	The display L1 is flashing. Press 🔢 to switch between the tariff switching modes mentioned above. The unit display switches between TARF and TYPE.
Main menu kWh /HT Submenu Tariff input Set tariff switching time Main menu kWh /HT	🔢 Set start time ▼ L3 flashes 🔢 Set end time ✖ cancel or ⊜ save ▶ or ▼	Int L1 TARF 22.00 L2 06.00 L3 ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ Harmon. ○ Extra	The display L2 is flashing. Press the button 🔢 to set the start or end time.

8.3 Measuring period synchronization

Menu	Key combination	Device display	Description
Submenu kWh /LT Submenu Measuring period	▶❙ Keep buttons depressed for 2 seconds	d.In L1 SYNC — ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I 15 L2 ○ S ○ P ○ Q ○ cos φ ● kWh 03.57 L3 ○ kvarh ○ Harmon. ○ Extra	When you call up the menu, the following text will be displayed in the unit display: SYNC PARAMETER SYNC Display L1 displays the synchronization type. The display L2 displays the measuring period in minutes. The time remaining until the next synchronization will take place is indicated in the display L3 in minutes and seconds. The following synchronization types can be selected: - Int by internal clock - d.In by external contact - bUS via Energy Bus command - tArF by tariff switching
Submenu Measuring period	▶❙ Start input mode 🔢 ..... ✖ cancel or ⊜ save	d.In L1 TYPE ○ U$_{Ph-N}$ ○ U$_{Ph-Ph}$ ○ I 15 L2 ○ S ○ P ○ Q ○ cos φ ● kWh 03.57 L3 ○ kvarh ○ Harmon. ○ Extra	The display L1 is flashing. Press 🔢 to switch between the tariff switching modes mentioned above.
Set measuring period synchronization			
Main menu kWh	▶ or ▼		
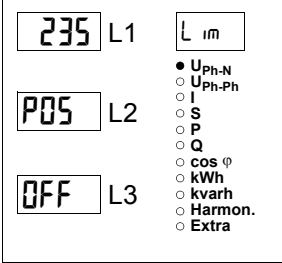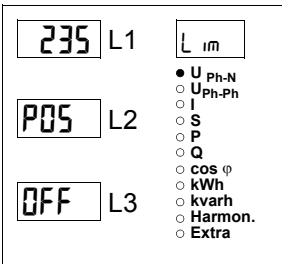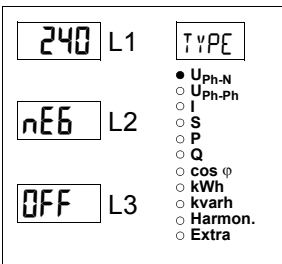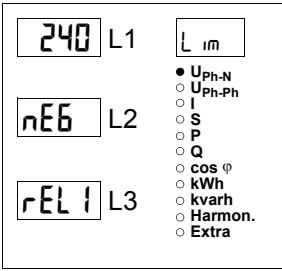
ℹ️ **Note**

In case of internal synchronization, the measuring period (in the kWh / LT submenu) can be restarted by pressing ✖ (for approx. 2 seconds)!

8.4   Configuring limits

The following section explains how to configure the limits; the limits 1 and 2 of the phase-to-neutral voltage serve as an example.

Menu	Key combination	Device display	Description
Submenu voltage U Ph-N Maximum	▶❙ Keep buttons depressed for 2 seconds ▶❙ Start input mode	235 L1 L ɪm ● U Ph-N ○ U Ph-Ph POS L2 ○ I ○ S ○ P ○ Q OFF L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	The display L1 shows the limit value. The display L2 shows the effective direction of the limit value. (Limit active if POS is exceeded or nEG is underrun or locked OFF.)
Submenu voltage U Ph-N Limit 1 Set Value	123 ..... ▶❙ next digit or ✗ cancel or ⊖ save	235 L1 L ɪm ● U Ph-N ○ U Ph-Ph POS L2 ○ I ○ S ○ P ○ Q OFF L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	The first digit is flashing in display L1. Press the button 123 to set the value of this digit. Press the button ▶❙ to switch to the next digit. If all digits have been set, the display L1 will be flashing. To move the decimal point, press the button ▶❙ .
Main menu U Ph-N	▶ or ▼		The unit display switches between LIM 1 and V.
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Voltage U Ph-N Limit 1 Set effective direction Main menu U Ph-N	▶❙ next digit or ✗ cancel or ⊖ save ▶ or ▼	240 L1 TYPE ● U Ph-N ○ U Ph-Ph nEG L2 ○ I ○ S ○ P ○ Q OFF L3 ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	The display L2 is flashing. Press the button 123 to select whether the limit is to be activated when exceeded (POS) or when the value falls below the limit (nEG) or whether it should be locked (OFF).
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
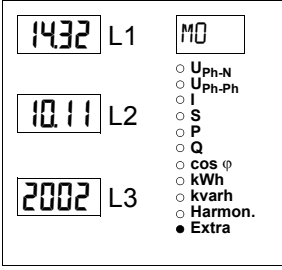
Menu	Key combination	Device display	Description
Submenu Voltage U Ph-N Limit 1 Set message type Main menu U Ph-N	▶❙ next digit or ✖ cancel or ⊖ save ▶ or ▼	240 L1 Lım • U Ph-N ○ U Ph-Ph ○ I nE6 L2 ○ S ○ P ○ Q ○ cos φ rEL1 L3 ○ kWh ○ kvarh ○ Harmon. ○ Extra	The display L3 is flashing. Use the button 🔢 to determine the message type for a limit violation. - Alarm at relay 1 (rEL1) - Alarm at relay 2 (rEL2) - Alarm only via KBR Energy Bus (OFF)
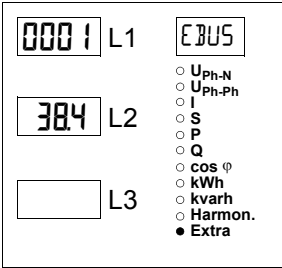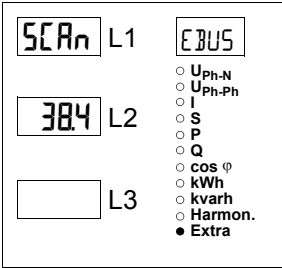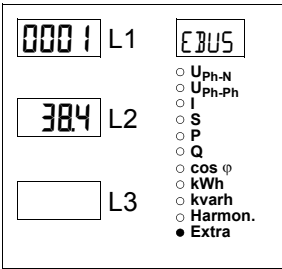
ℹ️ **Note**

If a relay is not configured as alarm relay, but as switching relay (setting only possible via E Bus), L3 does not display anything.
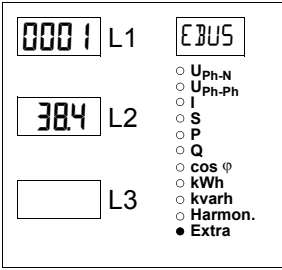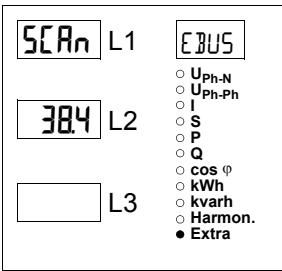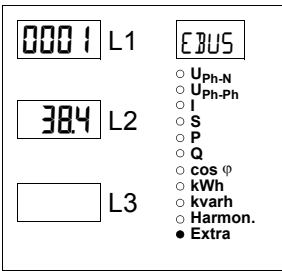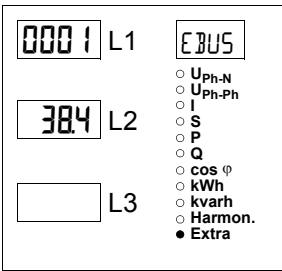
8.5 Setting time and date

Menu	Key combination	Device display	Description
Main menu Extras Submenu Date / time ▶❙ Start input mode		1432 L1 MO ○ U Ph-N ○ U Ph-Ph ○ I 10.11 L2 ○ S ○ P ○ Q ○ cos φ 2002 L3 ○ kWh ○ kvarh ○ Harmon. • Extra	The display L1 shows the time (hh.mm). Display L2 shows the date (dd.mm). Display L3 shows the year (yyyy). The unit display shows the day of the week.
Submenu Set date / time	🔢 ..... ▶❙ next digit or ✖ cancel or ⊖ save	1432 L1 MO ○ U Ph-N ○ U Ph-Ph ○ I 10.11 L2 ○ S ○ P ○ Q ○ cos φ 2002 L3 ○ kWh ○ kvarh ○ Harmon. • Extra	The first two digits in display L1 flash. Press the button 🔢 to set the value of these digits. Press the button ▶❙ to switch to the next digit. To set the day and month in display L2, proceed as described for display L1. The same applies to the year in the display L3.
Main menu Extra	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).

8.6   Set bus address
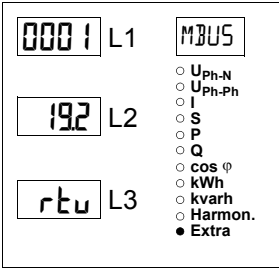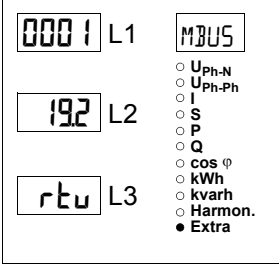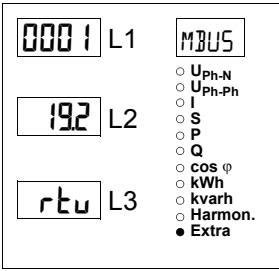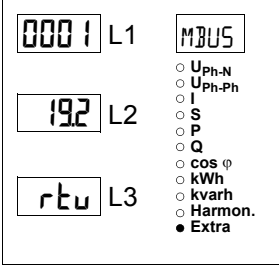
Menu	Key combination	Device display	Description
Main menu Extra Submenu E Bus	▶▌ Start input mode (BUS scan)	`0001` L1 `EBUS` ○ U_{Ph-N} `384` L2 L3	The display L1 shows the device address. The baud rate is displayed in display L2.
Submenu E Bus Assign address	▶▌ Start input mode	`SCAn` L1 `EBUS` `384` L2 L3	The display L1 indicates that the device is in scan mode. As soon as the device is recognized at the Bus, it is automatically assigned an address by the software and the address is entered in the device memory. The baud rate is displayed in display L2.
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu E Bus Assign address manually	123 ..... ▶▌ next digit or ✕ cancel or ⊖ save	`0001` L1 `EBUS` `384` L2 L3	The first digit is flashing in display L1. Press the button 123 to set the value of this digit. Press the button ▶▌ to switch to the next digit.
Main menu Extra	▶ or ▼		

For the device display cells, the indicator list shows:
○ U Ph-N
○ U Ph-Ph
○ I
○ S
○ P
○ Q
○ cos φ
○ kWh
○ kvarh
○ Harmon.
● Extra
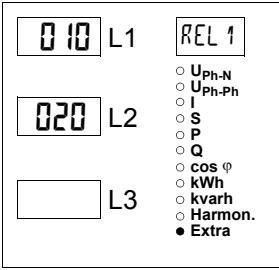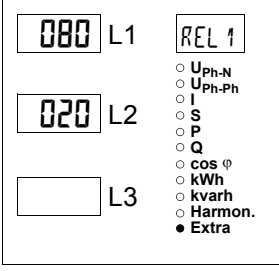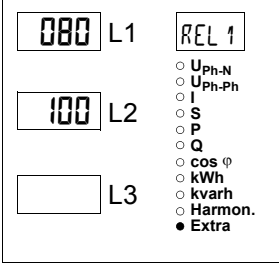
8.7   Setting the bus protocol

Menu	Key combination	Device display	Description
Submenu E Bus	▶ Start input mode (BUS scan)	`000 1` L1 `EBUS` `38.4` L2 L3 ○ U Ph-N ○ U Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the device address. The baud rate is displayed in display L2. The unit display shows the current bus protocol (e.g. E Bus).
Submenu E Bus Assign address	▶ Start input mode	`SCAn` L1 `EBUS` `38.4` L2 L3 ○ U Ph-N ○ U Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The first digit in display L1 is flashing. Press the button ▶ to enter the input mode for setting the bus protocol.
Submenu E Bus Assign bus protocol Main menu Extra	▼ ▼ .... 123 Selection ⊗ cancel or ⊖ save	`000 1` L1 `EBUS` `38.4` L2 L3 ○ U Ph-N ○ U Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the device address. The baud rate is displayed in display L2. The unit display flashes. Press the button 123 to select one of the different bus protocols (E Bus or Modbus).

8.8   Set bus address and baud rate for Modbus

Menu	Key combination	Device display	Description
Submenu Modbus	▶❙ Start input mode	000 1 L1 MBUS ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 19.2 L2 ○ S ○ P ○ Q ○ cos φ rtu L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the device address. The baud rate is displayed in display L2. Display L3 shows the selected bus protocol (RTU or ASC).
Submenu Modbus Assign address	123 ..... ▶❙ next digit or ⊗ cancel or ⊜ save	000 1 L1 MBUS ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 19.2 L2 ○ S ○ P ○ Q ○ cos φ rtu L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The first digit in display L1 is flashing. Press the button 123 to set the value of this digit. Press the button ▶❙ to switch to the next digit.
Main menu Extra	▶ or ▼		
Submenu Modbus Assign baud rate	123 next Baud rate ⊗ cancel or ⊜ save	000 1 L1 MBUS ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 19.2 L2 ○ S ○ P ○ Q ○ cos φ rtu L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L2 is flashing. Press the button 123 to choose between different baud rates with the respective parity even/odd or no parity. 4.8k baud 9.6k baud 19,2k baud
Main menu Extra	▶ or ▼		
Submenu Modbus Assign transmission mode	▼ next Baud rate ⊗ cancel or 123 Selection ⊜ save	000 1 L1 MBUS ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 19.2 L2 ○ S ○ P ○ Q ○ cos φ rtu L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L3 is flashing. Press the 123 button to choose between the different modes (RTU or ASC).
Main menu Extra	▶ or ▼		

8.9 Setting on-delay and off-delay of the relays
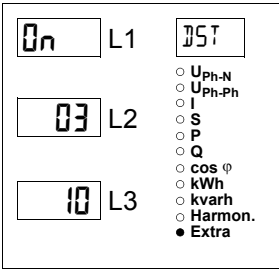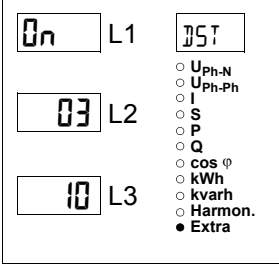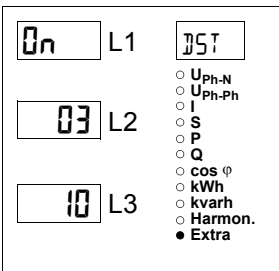
Menu	Key combination	Device display	Description
Submenu REL 1	![] Start input mode	010 L1 REL 1 020 L2 L3	The display L1 shows the on-delay for relay 1 in seconds. The display L2 shows the off-delay for relay 1 in seconds. The unit display switches between REL 1 and tON.
Submenu REL 1 Set on-delay	⌨ ..... ![] next digit or ✕ cancel or ⊖ save	080 L1 REL 1 020 L2 L3	The first digit in display L1 is flashing. Press the button ⌨ to set the value of this digit (max. 255 seconds). Press the button ![] to switch to the next digit.
Main menu Extra	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu REL 1 Set off-delay	⌨ ..... ![] next digit or ✕ cancel or ⊖ save	080 L1 REL 1 100 L2 L3	The first digit in display L2 is flashing. Press the button ⌨ to set the value of this digit (max. 255 seconds). Press the button ![] to switch to the next digit. The assignment as switching relay is shown in display L1 ----, display L2 ---- and in L3 BUS. Configuration is only possible via E Bus using optionally available software.
Main menu Extra	▶ or ▼		

> **ℹ Note**
>
> **The settings for relay 2 correspond to that of relay 1 described above.**

8.10 Activating daylight saving time
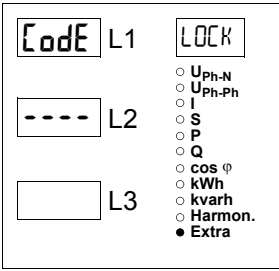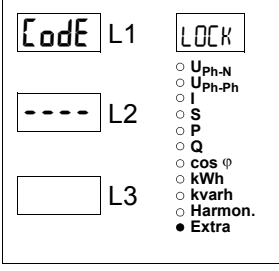
Menu	Key combination	Device display	Description
Submenu Daylight saving time	▶| Start input mode	`On` L1 `DST` ○ U_Ph-N ○ U_Ph-Ph ○ I `03` L2 ○ S ○ P ○ Q ○ cos φ `10` L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 indicates whether daylight saving time is activated or not. The display L2 shows the month daylight saving time begins. The display L3 shows the month daylight saving time ends. The unit display shows `DaYLiGhT SavinG` and then `DST`.
Submenu Set daylight saving time	123 ..... ▶| next digit or ✕ cancel or ⊖ save	`On` L1 `DST` ○ U_Ph-N ○ U_Ph-Ph ○ I `03` L2 ○ S ○ P ○ Q ○ cos φ `10` L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 is flashing. By pressing the 123 button, the daylight saving time can be activated (`On`) or deactivated (`OFF`).
Main menu Extra	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Set beginning of daylight saving time	123 ..... ▶| next digit or ✕ cancel or ⊖ save	`On` L1 `DST` ○ U_Ph-N ○ U_Ph-Ph ○ I `03` L2 ○ S ○ P ○ Q ○ cos φ `10` L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L2 is flashing. Press the button 123 to set the month daylight saving time begins. The unit display switches between `BEG` and `DST`.
Main menu Extra	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).

Menu	Key combination	Device display	Description

| Submenu Set end of daylight saving time | 123 ..... ▶ next digit or ✕ cancel or ⊖ save | On L1 / DST
○ U$_{Ph-N}$
○ U$_{Ph-Ph}$
○ I
03 L2 / ○ S
○ P
○ Q
○ cos φ
○ kWh
10 L3 / ○ kvarh
○ Harmon.
● Extra | The display L3 is flashing.
Press the button 123 to set the month daylight saving time ends.
The unit display switches between END and DST. |

| Main menu Extra | ▶ or ▼ | | |
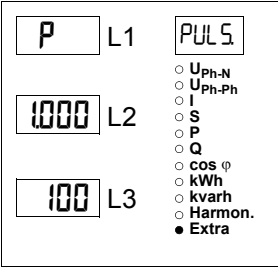
8.11 Language settings

Menu	Key combination	Device display	Description

| Submenu Language | ▶ Start input mode | EnbL. L1 / LANG
○ U$_{Ph-N}$
○ U$_{Ph-Ph}$
○ I
L2 / ○ S
○ P
○ Q
○ cos φ
○ kWh
L3 / ○ kvarh
○ Harmon.
● Extra | The display L1 is flashing.
For German, it displays dEUt
For English, EnbL
The unit display shows SPRA when the user language is German and LANG for English. |

| Submenu Set language | 123 ..... or ✕ cancel or ⊖ save | EnbL L1 / LANG
○ U$_{Ph-N}$
○ U$_{Ph-Ph}$
○ I
L2 / ○ S
○ P
○ Q
○ cos φ
○ kWh
L3 / ○ kvarh
○ Harmon.
● Extra | The display L1 shows the user language.
Press the button 123 to select the user language.
For German, it displays dEUt
For English, EnbL
The unit display shows SPRA when the user language is German and LANG for English. |

| Main menu Extra | ▶ or ▼ | | |

8.12 Password

Menu	Key combination	Device display	Description
Submenu Password	▶‖ Start input mode	[CodE] L1 [LOCK] / ---- L2 / L3	The display L1 shows CODE. The unit display shows LOCK or FREE. If the device is unlocked, the code number will be displayed in L2. If the device is locked, ---- will be displayed. The device is defaulted with the code 9999, i.e. all functions of the device are available.
Submenu Password Input	🔢 ..... ▶‖ next digit or ✖ cancel or ⊖ save	[CodE] L1 [LOCK] / ---- L2 / L3	The display L1 shows CODE. The unit display shows LOCK or FREE. L2 displays 9999. The display L2 is flashing. Press the button 🔢 to set the value of this digit Press the button ▶‖ to switch to the next digit.
Main menu Extra	▶ or ▼		

8.13 Configuring pulse output

Menu	Key combination	Device display	Description
Submenu Pulse output	▶‖ Start input mode	[P] L1 [PULS.] / 1.000 L2 / 100 L3	The display L1 indicates whether the pulse output is deactivated (OFF) or configured for active (P) or reactive (q) energy. The display L2 shows the pulse value, i.e. pulse/kWh or kVARh. The display L3 displays the energy pulse duration in msec.

Menu	Key combination	Device display	Description
Submenu Pulse output Set pulse source	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	P L1 SRC. ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 1.000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	When calling the menu, the following text will be displayed in the unit display: SRC. SOURCE The display L1 is flashing. Press the 🔢 button to choose between active energy (P consumption or P-recovery), reactive energy (q consumption or q- recovery) or deactivated energy pulse (OFF).
Main menu Extra	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Pulse output Set pulse value	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	P L1 VAL. ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 1.000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	When calling the menu, the following text will be displayed in the unit display: VAL. VALENCY The first digit in display L2 is flashing. Press the button 🔢 to set the value of this digit Press the button ▶ to switch to the next digit. If all digits are flashing, you can move the decimal point with the button 🔢.
Main menu Extra	▶ or ▼		
Note	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Pulse output Set duration	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	P L1 LEN. ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I 1.000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	When calling the menu, the following text will be displayed in the unit display: LEN. LENGTH The first digit in display L3 is flashing. Press the button 🔢 to set the value of this digit. Press the button ▶ to switch to the next digit.
Main menu Extra	▶ or ▼		
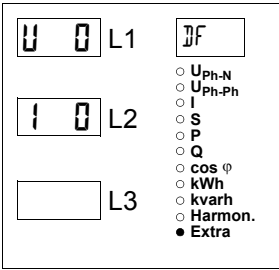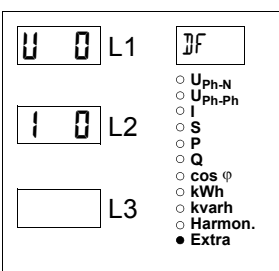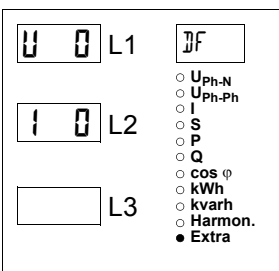
> ## i Note
>
> **If the "Extra" LED flashes after the pulse value is entered, please proceed as follows. The "Extra" LED flashes until a matching (lower) pulse count or pulse duration is entered.**

Check the pulse value with reference to the pulse duration. If required, correct the pulse length or the pulse value.
The maximally processable active or reactive energy can be estimated by means of the following calculation.
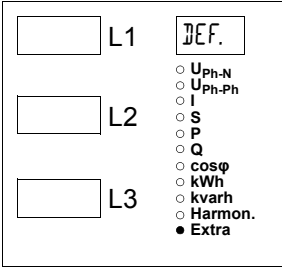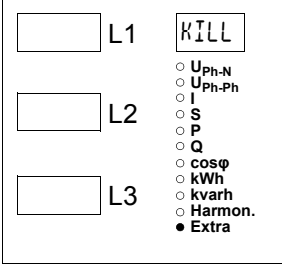
$$\frac{3600s}{2 \; x \; IL \; x \; IP/kWh\,(k\,var\,h)} = Maxvalue$$

Explanation:
3600	Constant [s]
IL	Required pulse length [s]
IP/kWh(kvarh)	Required pulse count per kWh or per kvarh [Imp/kWh or Imp/kvarh]
Maximum value	Maximum active or reactive energy that can be output [kWh or kvarh].
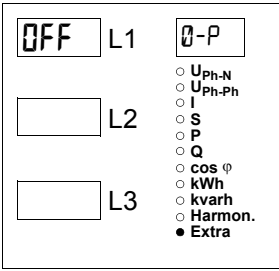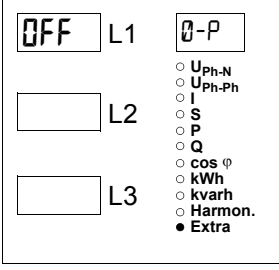
8.14 Damping factor

Menu	Key combination	Device display	Description
Submenu Damping factor	▶️ Start input mode	U 0 L1 · DF 1 0 L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The display L1 shows the damping coefficient for acquiring the voltage. The display L2 shows the damping coefficient for acquiring the current.
Submenu Damping factor Set voltage	🔢 ..... ▶️ next digit or ❌ cancel or ⊜ save	U 0 L1 · DF 1 0 L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	When calling the menu, the following text will be displayed in the unit display: DF DAMPINGFACTOR The first digit in display L1 is flashing. Press the button 🔢 to set the value of this digit. Range of values: 0 - 8
Main menu Extra	▶️ or 🔽		
Note	▶️ or 🔽		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Damping factor Set current	🔢 ..... ▶️ next digit or ❌ cancel or ⊜ save	U 0 L1 · DF 1 0 L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	The first digit in display L2 is flashing. Press the button 🔢 to set the value of this digit. Range of values: 0 - 8
Main menu Extra	▶️ or 🔽		
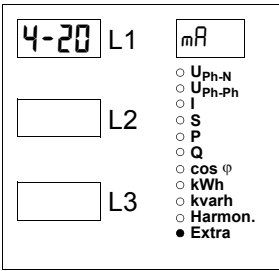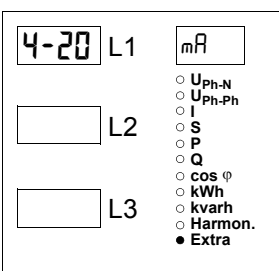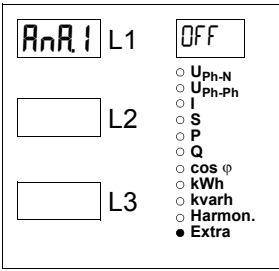
8.15 Default parameters

Menu	Key combination	Device display	Description
Submenu Default parameters		L1 [DEF.] ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I L2 ○ S ○ P ○ Q ○ cosφ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The unit display shows DEF.
Submenu Default parameters Perform reset to default parameters	Press [123] + [⊗] + [▶] at the same time.	L1 [KILL] ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I L2 ○ S ○ P ○ Q ○ cosφ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	When you press these three keys at the same time, the following text is displayed in the unit display: KILL The device is now reset to its default parameters (factory settings) and all memory / storage data are deleted.
Main menu Extra or next submenu	[▼] or [▶]		

8.16 Zero point creator

Menu	Key combination	Device display	Description
Submenu zero point creator	▶ Start input mode	OFF L1 0-P ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra L2 L3	The display L1 shows the state of the zero point creator.
Submenu zero point creator (activate)	[123] ..... ✕ cancel or ⊜ save	OFF L1 0-P ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra L2 L3	When you call up the menu: The display L1 is flashing. Press the button [123] to set up this function. Possible values: OFF, On
Main menu Extra or next submenu	▼ or ▶		

8.17 Analog outputs

Menu	Key combination	Device display	Description
Submenu Analog outputs	▶❙ Start input mode	4-20 L1 mA L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	Display L1 shows the output value of the analog outputs 1 to 3.
Submenu Analog outputs Set output type	123 ..... ⊗ cancel or ⊜ save	4-20 L1 mA L2 L3 ○ U_Ph-N ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	When you call up the menu, 4-20 is flashing in display L1. Press the button 123 to select the output type. Possible values: 0 - 20 mA 4 - 20 mA 0 - 10 V 2 - 10 V

Main menu
Extra
  or
  next
  submenu
	▼
	or
	▶		

next submenu	▶❙ Start input mode		

Submenu
  Analog
  outputs
  Activate
  Output 1 and
  Select
  output
  data point
	123 .....
	
	⊗ cancel
	or
	⊜ save
		AnA.1 L1 OFF
		L2
		L3
		○ U_Ph-N
		○ U_Ph-Ph
		○ I
		○ S
		○ P
		○ Q
		○ cos φ
		○ kWh
		○ kvarh
		○ Harmon.
		● Extra
			When you call up the menu, OFF is flashing in the unit display.
			Press 123 to activate the output and to set up the outputdata point.
			
			Possible values:
			refer to the following output data points

Set lower limit	▶ or ▼		

The following output data points are available:

Off   (output deactivated)

Voltage U PH-N L1
Voltage U PH-N L2
Voltage U PH-N L3
Voltage U PH-PH L12
Voltage U PH-PH L23
Voltage U PH-PH L31

Apparent current Is L1
Apparent current Is L2
Apparent current Is L3
Apparent current average value L1
Apparent current average value L2
Apparent current average value L3

Apparent power L1
Apparent power L2
Apparent power L3

Active power L1
Active power L2
Active power L3
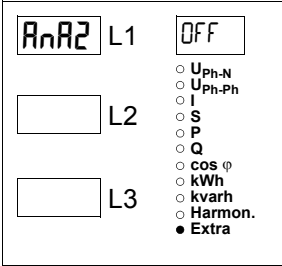
Reactive power L1
Reactive power L2
Reactive power L3

CosPhi L1
CosPhi L2
CosPhi L3

Power factor L1
Power factor L2
Power factor L3

Power frequency
Apparent current neutral conductor
Apparent current neutral conductor average value
Total active power
Total reactive power
Total apparent power
Total power factor

Menu	Key combination	Device display	Description
Submenu Analog outputs			Display L1 shows the analog output 1. Display L2 shows the lower limit and flashes. Display L3 shows the upper limit.
Set lower limit			
Note	▶❙		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Analog outputs Set lower limit	[123] ..... ⊗ cancel or ⊜ save or ▶ or ▼		The first digit in display L2 is flashing. Press the button [123] to set the value of this digit. Press ▶❙ to switch between the individual digits. If all digits are flashing, you can move the decimal point with the button [123]. The unit display is also changed.
Set upper limit			
Note	▶❙		Use these buttons to switch between the individual displays in input mode (one digit will be flashing).
Submenu Analog outputs Set upper limit	[123] ..... ⊗ cancel or ⊜ save or ▶ or ▼		The first digit in display L3 is flashing. Press the button [123] to set the value of this digit. Press ▶❙ to switch between the individual digits. If all digits are flashing, you can move the decimal point with the button [123]. The unit display is also changed.
Set output data point			

Device display (first):

AnA1 L1   U L1
0.00 L2   ○ U Ph-N
           ○ U Ph-Ph
           ○ I
           ○ S
           ○ P
           ○ Q
           ○ cos φ
           ○ kWh
0.00 L3   ○ kvarh
           ○ Harmon.
           ● Extra

Device display (second):

AnA1 L1   U L1
1.00 L2   ○ U Ph-N
           ○ U Ph-Ph
           ○ I
           ○ S
           ○ P
           ○ Q
           ○ cos φ
           ○ kWh
0.00 L3   ○ kvarh
           ○ Harmon.
           ● Extra

Device display (third):

AnA1 L1   U L1
1.00 L2   ○ U Ph-N
           ○ U Ph-Ph
           ○ I
           ○ S
           ○ P
           ○ Q
           ○ cos φ
           ○ kWh
460 L3   ○ kvarh
           ○ Harmon.
           ● Extra

Menu	Key combination	Device display	Description
Main menu Extra or next submenu	▼ or ▶		
next submenu	▶❘ Start input mode		
Submenu Analog outputs Output 2 Activate and select output data point	🖩 ..... ⊗ cancel or ⊖ save	`AnA2` L1 `OFF` ○ U_{Ph-N} L2 ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	When you call up the menu, `OFF` is flashing in the unit display. Press the button 🖩 to set up the output data point.
Set lower limit	▶ or ▼		

Note

The analog outputs `AnA2` and `AnA3` can be set up the same way as analog output `AnA1`.

9 Reset and delete functions

9.1 Reset

Reset should only be performed when commissioning and completely reconfiguring the device.
Caution! Reset will delete all configured values and return to factory settings!

Reset is carried out in the **menu Extra - submenu Default parameter**.
Keep the buttons **digit**, **delete** and **right arrow** depressed simultaneously.
The 15-segment display will show "KILL" during reset.
The device is reset to its **Default parameters**, i.e. all stored data are **lost!**
This includes all operating parameters, limits and extreme values as well as the release delay of the signaling relays. The memory for limit violations is deleted.
The settings for time, date and bus address are not affected by a reset.

Check all operating parameters for correctness!
Default parameters can be found in chapter 10.10.

9.2 Delete energy counter

9.2.1 Delete energy counter manually

To delete the currently displayed continuous energy counter value (active or reactive energy, HT or LT,

consumption or recovery), press the button for approx. 2 seconds.

9.2.2 Delete energy meter centrally

The entire contents of the energy meter may only be deleted by a device reset or, using the optionally available software, via the KBR Energy Bus.

9.3 Deleting extreme values

9.3.1 Delete individual extreme value

The currently displayed extreme values (minimum or maximum) can be deleted by pressing the

 button for approx. 2 seconds.

9.3.2 Delete extreme values centrally

If you want to delete all minimum and maximum values, keep the buttons and depressed for approximately 2 seconds while any minimum or maximum value is being displayed. The function is also available via the KBR Energy Bus.

9.4 Deleting limit settings

9.4.1 Delete limit settings manually

Deactivating individually configured limits is only possible in the programming mode.
In the programming mode, set the limit type of the respective value you want to deactivate to "OFF" .

9.4.2 Delete limit settings centrally

If you want to delete all limits, keep the buttons and depressed for approximately 2 seconds while any limit is being displayed. The function is also available via the KBR Energy Bus.

10 Memory functions

10.1 Device settings

All device settings and parameter data for storage utilization are stored in the device.

10.1.1 Devices - basic parameters

Parameters	Stored by user
Measurement voltage	programmable by user from 0001V … 999.9 kV programmable
Measurement current; transformer primary current	programmable by user from 0001A … 999.9 kA programmable
Measurement current (at device input, i.e. secondary transformer!)	can be selected by user: 1A or 5A
Pulse output type / pulse value / pulse length	according to user settings
Tariff switching	User can select from digital input, switching via energy bus or times programmed in the device
Synchronization settings	Options for settings - refer to chapter 9.1.3 Measuring period synchronization
Bus address	according to user settings between 0001 and 9999
Time	according to user settings in hh:mm:ss
Password	according to user settings Password is a 4-digit number (leading zeros) 9999 means: Device is not password-protected
Device name	any name chosen by the user [1*)]
Event name	an individual designation is assigned to every event [1*)]
Measuring period	1 / 15 / 30 / 60 min [1*)]
Analog outputs	can be set by the user: 0-10V, 2-10V 0-20mA or 4-20mA

[1*)] This function can only be set by means of the computer with optionally available software (e.g. Visual Energy).

10.1.2 Long-term memory

The **multimess 4F144-2-LED-ESMS-…** offers the user the long-term memory described in the following section.

10.1.2.1 Load profile memory

The measuring device is equipped with a load profile memory which can record up to a maximum of 35136 entries depending on the number of parameters to be saved (active power periods for HT and LT, consumption and recovery, reactive power periods for HT and LT, capacitive and inductive) and a measuring period that can be selected by the user (possible period values 60 / 30 / 15 / 1 minutes).
This means that a period of 15 min. results in a maximum storage duration of 365 days.
The measuring period and the selection of the parameters to be saved can be parameterized via the computer with optionally available software.

Note

Setting the device-internal clock:
If the time of the multimess 4F144-2-LED-ESMS-… is adjusted by less than the duration of one period, the measurement for the instantaneous period is finished at the next synchronization event and saved.
If the time of the multimess 4F144-2-LED-ESMS-… is adjusted back by more than the duration of one period, the load profile memory is deleted and restarted.
In both cases, a clock adjustment event is created and saved in the event memory.
Adjusting the period duration:
If the period duration is adjusted, the load profile memory is deleted and restarted.
An adjustment event (adjustment of the parameters) is created and entered in the event memory.

10.1.2.2 Annual energy memory

The daily energy values of the past 365 days for W_{Act} consumption, W_{Act} recovery, W_{React} inductive and W_{React} capacitive are stored in an annual energy memory separated for high and low tariff.

10.1.2.3 Event memory

The event memory saves 4096 events with date, time and status in a ring buffer.

The following events are acquired:

Event	Acquisition
Tariff input	Switchover signal HT => LT with date and time Switchover signal LT => HT with date and time
Sync input	Intermediate synchronization with date and time, specification of synchronization type
Power failures	with date, time and duration of the power failure
Error	Error type with date and time
Changed settings / deletions (Powerfail entry)	e.g. reset via EBUS / set clock / deletions / parameter changes leading to deletions
Measurement voltage failures	If the power is reduced to 85% of the rated voltage for longer than 20ms, configurable via computer.

> ## ⓘ Note
>
> **The described memories can only be read or parameterized via the Energy Bus by means of optionally available software (e.g. Visual Energy).**

10.1.3 Measuring period synchronization

Measuring period synchronization of the **multimess 4F144-2-LED-ESMS-…** can be carried out in four ways, while the measuring period duration can be adjusted as described in chapter 9.1.2.1 Load profile memory. The measuring period duration and the synchronization always affect all period values.

The following 4 types of synchronization are possible:

10.1.3.1 Synchronization only by internal clock

The synchronization by internal clock is started with the manufacturer's reset. From this time onwards, the clock synchronizes the measuring period every 15 minutes.

> ## ⓘ Note
>
> **In case of internal synchronization, the measuring period (in the kWh / LT submenu) can be restarted by pressing the button (for approx. 2 seconds)!**

10.1.3.2 Synchronization by the energy supplier's synchronous pulse

If the synchronous pulse is available as floating contact from the energy supplier, it can be connected to the synchronization input. If the contact closes for at least 250 ms, it will be recognized as synchronous pulse and the measuring period is restarted.
Under certain operating conditions, the energy supplier may carry out an intermediate synchronization while a measuring period is still running. The **multimess 4F144-2-LED-ESMS-…** terminates the instantaneous period measurement and saves the period value together with a timestamp. The time pattern is shifted to the new start time and a new measurement is started immediately.
Example:
Period duration is set to 15 min
   i.e. 20 kW input power results in a period value of 20 kW (15 min period)
   if there is an intermediate synchronization 3 min after period start and this 3 min period is saved,
   the period value to be recorded will be 4 kW.
If the energy supplier's synchronous pulse is not available, the status message "ext. synchronous pulse missing" is issued and the internal clock continues the time frame.

10.1.3.3 Synchronization by KBR ENERGY BUS

Synchronization is carried out via a telegram created either by the computer or by the MULTIMASTER and sent via the KBR ENERGY BUS to the selected recipients.
Under certain operating conditions, an intermediate synchronization may be carried out while a measuring period is still running. The **multimess 4F144-2-LED-ESMS-…** terminates the instantaneous period measurement and saves the period value together with a timestamp. The time pattern is shifted to the new start time and a new measurement is started immediately.

Example:

Period duration is set to 15 min

   i.e. 20 kW input power results in a period value of 20 kW (15 min period)

   if there is an intermediate synchronization 3 min after period start and this 3 min period is saved,

   the period value to be recorded will be 4 kW.

If the bus's synchronous pulse is not available, the status message "ext. synchronous pulse missing" is issued and the internal clock continues the time frame.

10.1.3.4 Synchronization at tariff change

This type of synchronization makes it possible for the measuring unit to change tariffs immediately after the tariff HT/LT has been switched instead of waiting until the end of the measuring period.

The internal clock synchronizes the measuring period. If the tariff is changed, depending on the configuration by contact at the HT/LT input or by bus signal, this event will additionally synchronize the measuring period. Under certain operating conditions, the synchronization pulse and the internal measuring period synchronization may not be in accordance with the same time pattern. The **multimess 4F144-2-LED-ESMS-…** terminates the instantaneous period measurement and saves the period value together with a timestamp. The time pattern is shifted to the new start time and a new measurement is started immediately.

Example:

Period duration is set to 15 min

   i.e. 20 kW input power results in a period value of 20 kW (15 min period)

   if synchronization is carried out 3 min after period start and if this 3 min period is saved,

   the period value to be recorded will be 4 kW.

11 Technical data

11.1 Measuring and display values

Waveform for U and I		any
Voltage	Actual value of a measuring interval	Phase - 0: U_{L1-N}; U_{L2-N}; U_{L3-N} / phase - phase: U_{L1-2}; U_{L2-3}; U_{L3-1}
	Units	[V, kV] display is switched automatically
	Measuring range	0.00kV to 999.9kV
Current (apparent)	Actual value of a measuring interval	$I_{L1 Act}$; $I_{L2 Act}$; $I_{L3 Act}$; Instantaneous value per phase
	Average value formation	$I_{L1 Av}$; $I_{L2 Av}$; $I_{L3 Av}$; floating average value from actual values over a programmable period of time
	Units	[A;kA;MA] display is switched automatically
	Measuring range	0.00A to 999.9kA
Neutral conductor	Actual value of a measuring interval	$I_{N Inst}$ / $I_{N Avg}$ Instantaneous and average value - refer to "Phase current"
	Units	[A;kA;MA] display is switched automatically
	Measuring range	0.00A to 1.2 MA
Frequency	Power frequency measurement	f_{Power} ; measured with power supply correction
	Units	[Hz]
	Measuring range	40....70Hz
Apparent power	Calculation	S_{L1}; S_{L2}; S_{L3}; S_{tot}
	Units	[VA; kVA; MVA] display is switched automatically
	Measuring range	0.00VA to 999MVA
Active power	Calculation	P_{L1}; P_{L2}; P_{L3} ; P_{total};
	Units	[W; kW; MW] display is switched automatically
	Measuring range	0.00W to 999MW
Reactive power	Calculation → ind. & cap.	Q_{L1}; Q_{L2}; Q_{L3}; Q_{total}; distinction between ind./cap.
	Units	[Var; kvar; Mvar] display is switched automatically
	Measuring range	0.00Var to 999MVar
Power factor	Calculation → ind. & cap.	$\cos\varphi_{L1}$; $\cos\varphi_{L2}$; $\cos\varphi_{L3}$; PF_{L1}; PF_{L2}; PF_{L3}; $PF_{tot.}$; distinction between ind./cap. $\cos\varphi$ in the display
	Measuring range	CosPhi 0.1ind. ← 1 → 0, 1cap., PF 0.1 - 1
Active energy	Calculation	W (HT/LT); $P_{average max.}$ of a measuring period
	Units	[Wh; kWh; MWh] display is switched automatically
	Measuring range	0.0kWh to 9999999999.9kWh
Reactive energy	Calculation	$W_{react.}$ (HT/LT) → ind. or cap. $Q_{average max.}$ of a measuring period;
	Units	[varh; kvarh; Mvarh]; display is switched automatically
	Measuring range	0.0kvarh to 9999999999.9kvarh
Harmonics Harmonics	Distortion factor (THD) of voltage	Voltage: $DF-U_{L1}$; $DF-U_{L2}$; $DF-U_{L3}$,
	Partial distortion factors	3.; 5.; 7.; 9.; 11.; 13.; 15.; 17. and 19th voltage harmonic
	Units	[%]
	Measuring range	0.00% to 100%
Current harmonics	Current harmonics Total of current harmonics	3.; 5.; 7.; 9.; 11.; 13.; 15.; 17. and 19th harmonic for each phase Current: I_{totL1}; I_{totL2}; I_{totL3} for each phase separately
	Units	[A]
	Measuring range	0.00A to 999.9kA

11.2 Measuring accuracy

Current	± 0.5 % / ± 1digit
Voltage	± 0.5 % / ± 1digit
Apparent power	± 1 % / ± 1digit
Active power	± 1 % / ± 1digit
Reactive power	± 1 % / ± 1digit
Power factor	± 1 % / ± 1digit
Frequency	± 0.1 Hz / ± 1digit

11.3 Measuring principle

Reading	128 values per period
A/D converter	10 bit
Measuring U and I	Acquiring measuring values for U and I simultaneously;
Updating speed (complete measuring cycle)	~ 330 ms
Calculation of harmonics	DFT with 128 points over one period
Frequency measurement	Consumption: Voltage measured between phase L1, L2, L3 - N; correct frequency measurement due to power supply correction

11.4 Device memory

Main and data memory	2 MB RAM battery-buffered
Program and parameter memory	256 kB flash
Memory type	Ring buffer
Long-term memory (1 year) - only for Comfort	Daily values for active and reactive energy (HT and LT) for consumption and
Long-term memory 160 / 80 / 40 days / 64 hours	60 / 30 / 15 / 1 minute – average values of: P_{total}; Q_{total}
Extreme values (Max./Min.)	extreme values that occurred after power connection or manual deletion of extreme values (maximum indicator function) including date and time
Event memory: Memory size	4096 events including date and time they occurred
Limit violations acquisition time	≥ 550 ms
Voltage dips during acquisition time Measurement voltage	≥ 20 ms; Threshold can be set using the computer, value after reset 85% of rated voltage (according to EN61000-4-30).
Battery life	approx. 5 years acc. to manufacturer's specifications

11.5 Power supply

Power supply	85 - 265V AC/DC (**-US1**) or 20 -70V AC/DC;15VA (**-US5**) **other variants see nameplate**

11.6 Hardware inputs and outputs

11.6.1 Inputs

Measuring inputs for Voltage	U_{L1-L2}; U_{L2-L3}; U_{L3-L1}	3 x 5V...**100V**...120V AC (measuring range 1)
		3 x 20V...**500V**...600V AC (measuring range 2)
	Input impedance	1.2 MOHM (Ph-Ph)
	Measuring range	programmable
Measuring inputs for Current	I_{L1}; I_{L2}; I_{L3}	3 x 0.01A...**1A**...1.2A AC (measuring range 1)
		3 x 0.05A...**5A**..0.6A AC (measuring range 2)
	Power consumption	$\leq$ 0.3VA per input at 6A
	Measuring range	programmable
Digital inputs	Tariff input	digital input for floating contact Switching HT/LT, signal e.g. from energy supplier Contact open => Tariff HT Contact closed => Tariff LT
	Synchronous input	digital input for floating contact Synchronization of measuring period; pulse length $\geq$ 250ms
	Power supply	27V / 15mA DC

11.6.2 Outputs

Signaling relay for limit violations	Number	2
	Contact	floating, open in case of limit violation
	Reaction speed	programmable, max. 255 sec.
	Switching capacity	250V (AC) / 2A
Pulse output	Output type	in proportion to active or reactive energy ➜ programmable on the device min. 0.001 pulse/kWh, max. 9990 pulse/kWh
	Optocoupler output	15 mA at max. 35V; S_0 interface
	Accuracy class	2
	Pulse duration	programmable, at least 30 ms, max. 999 ms
	Power supply	external
Analog output	Number	3
	Load capacity	20mA max for current output 10V max. for voltage output (max. load 500 Ohm) (min. load 500 Ohm)
	Signal	Can be set to 0-10V, 2-10V or 0-20mA, 4-20 mA
serial port	BUS	RS485 for connection to the Energy Bus; max. 32 devices, up to 1000 devices with bus amplifier
	Baud rate	38400
	Addressing	Can be addressed up to address 9999; automatically via software or manually

11.7 Electrical connection

Connection elements		Plug-in terminals
Permissible cross section of the connection lines		2.5 mm^2
Measurement voltage inputs	Fuse protection	max. 6 A
Measurement current	Fuse protection	NONE!!! Always short-circuit current transformer terminals k and l prior to opening the circuit!
Input control voltage	Fuse protection	max. 6 A
Relay output	Fuse protection	max 2A medium time lag
BUS connection	Connection material	For proper operation please only use shielded twisted-pair cables; e.g. I-Y-St-Y2x2x0.8 EIB

Pulse output	Connection & cables	ensure proper polarity!
		For proper operation please only use shielded twisted-pair cables;
		e.g. I-Y-St-Y2x2x0.8
Transformer connection	Connections	see connection chart
Analog output	Connections	ensure proper polarity!
Interface connection	BUS connection pins via RS485	**Device** / **MULTIMASTER or** / **interface adapter**
		Terminal 90 (⊥) → pin ⊥ → see software manual
		Terminal 91 (A) → pin A → see software manual
		Terminal 92 (B) → pin B → see software manual

11.8 Mechanical data

Panel device	Housing measures	144 x 144 x 60 mm (H x W x D)
	Mounting cutout	138 x 138 mm
	Mode of protection	Front IP51 (with optionally available front door max. IP54), terminals IP20
	Weight	750 g

11.9 Standards and other

Environmental Conditions	standards and amendments Amendments	DIN EN 60721-3-3/A2: 1997-07; 3K5+3Z11; (IEC721-3-3; 3K5+3Z11)
	Operating temperature	- 5°C … +55°C
	Humidity	5% … 95%
	Storage temperature	-25°C … +70°C
Electrical safety	Standards and amendments Amendments	DIN EN 61010-1/A2: 1996-05; (IEC1010-1/A2)
	Protection class	II, in accordance with DIN EN 61010-/A2: 1996-05
	Overvoltage category	CAT III: U_{PH-PH} up to 400V
		CAT II: U_{PH-PH} up to 600V
	Mode of protection	Front IP 51 (with optionally available front door max. IP 54)
		Terminals IP 20
		improved mode of protection possible via additional seals on request;
		DIN EN 40050 part 9: 1993-05
	Electromagnetic Compatibility	DIN EN 50081-1: 1993-03 DIN EN 61000-6-2: 2000-03; (IEC 61000-6-2)
Password protection	4-digit	Deleting and programming parameters on the device is not enabled if password protection is active.
EMC	Compatibility	
	complies with	EN 61010-1; EN 50081-1
Synchronization	Types	internal, manually, tariff switching or via Energy Bus (e.g. MULTIMASTER)
Synchronization time point	configurable	manually once per measuring period if the internal synchronization type is selected.

11.10 Default settings after reset

Primary voltage / secondary voltage	400 V
Primary current / secondary current	5 A
Measuring period duration	15Min. Measuring period
Daylight saving time	from March to October
Low tariff time	Switching activated via hardware input on the device,
	programmed time for internal switching of HT and
	LT: int. 00.00 to 00.00 (no low tariff time activated)
Language	GERM. (German text display)
Damping coefficient for current and voltage	DC 0 (no damping)
Energy pulse	P. (active power for consumption) 1 pulse/kWh, pulse duration 100 ms
Alarm relay	On-delay tON = 0 sec
	Off-delay tOFF = 0 sec
Analog output	deactivated
Measuring period synchronization	Energy bus
Password	9999 / all functions can be accessed
Period entries in the load profile memory	35136 entries

Unchanged by a RESET:

1. Bus address
2. Clock time

12   Serial interface

12.1   RS 485 Bus operation

The RS485 port of the **multimess 4F144-2-LED-ESMS-…** is designed for operation at the KBR Energy Bus. You can operate one or several **multimess 4F144-2-LED-ESMS-…** devices together with the **ENERGY BUS** across *great distances*. The bus is connected to the computer via the interface converter **E-BUS-232-485** or the **MULTIMASTER**. With the corresponding Windows® Software, all bus devices can be parameterized and visualized. On demand, we will be glad to provide information on which other devices you can connect to the Energy Bus and on the functions of our Windows® software.
Information on the structure and the technical parameters of the Energy Bus can be found in our installation guide for the KBR Energy Bus. Just send a request for this installation guide.

13   Overvoltage and lightning protection

We recommend to install overvoltage protection in order to prevent damage to our high-quality electronic products. It is recommended to protect control voltage inputs, pulse and bus lines.

14   Error detection

No function.

Check power supply, back-up fuse and supply line.

The measurement voltage of a phase is 0V.

Check back-up fuse of the phase.

A phase of the current display has a different sign.

Check k and l of current measurement and correct, if required.

Compared to the power supplier measurement values, the measured values for energy and power

Check k and l of the current measurement as well as the correctness of the phases of the transformers and adjust, if required.

One of the ⟨8⟩ LEDs flashes.

The most recent limit violation occurred in the menu indicated.

ErrU OVERLOAD or ErrI OVERLOAD.

ErrU: Overload at the voltage input of the measuring amplifier.
Switch off measurement voltage and check programmed transformer ratio. In case of direct measurement, the programmed secondary voltage value must be identical with the mains voltage. Note: The device selects the measuring range depending on the secondary voltage configured. If the configured secondary voltage value does not exceed 110V, the **multimess 4F144-2-LED-ESMS-…** works in measuring range 1. If it does, **multimess 4F144-2-LED-ESMS-…** will work in the measuring range 2.

ErrI: Overload at the current input of the measuring amplifier.
Adjust programming and select wider measuring range. Alternatively, switch off measurement current and check transformer ratio.
Note: The device selects the measuring range depending on the programmed secondary current, i.e. either measuring range 1 at 1A or measuring range 2 at 5A.
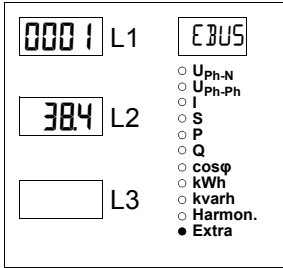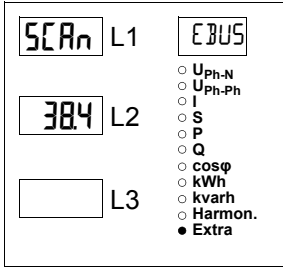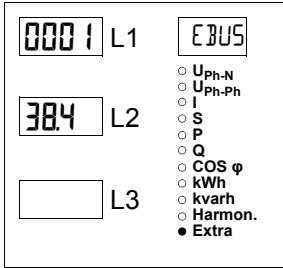
15   Appendix

15.1 Added functionality: Profibus
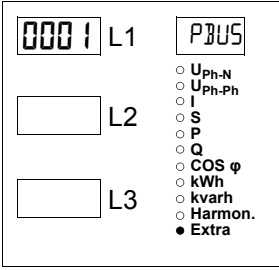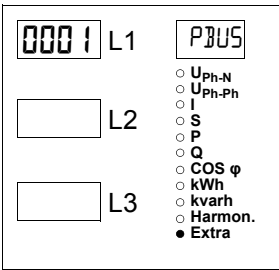
The **multimess 4F144-2-LED-ESMS-...** is now also available with the Profibus option (new name **4F144-2-LED-ESMSDP-...**).
The additional functions are described in this appendix (Configuring Profibus).

15.1.1   Setting the bus protocol

| Menu	Key combination	Device display	Description
Main menu Extras			
Submenu EBUS		$\boxed{0001}$ L1 $\boxed{EBUS}$ $\boxed{38.4}$ L2 L3	The display L1 shows the device address. The baud rate is displayed in display L2. The unit display shows the current bus protocol (e.g. E Bus).
	▶ Start input mode (EBUS scan)		
Submenu EBUS Assign address		$\boxed{5CAn}$ L1 $\boxed{EBUS}$ $\boxed{38.4}$ L2 L3	The first digit in display L1 is flashing. Press the button ▶ to enter the input mode for setting the bus protocol.
	▶ Start input mode		
Submenu EBUS Assign bus protocol	▼ ▼	$\boxed{0001}$ L1 $\boxed{EBUS}$ $\boxed{38.4}$ L2 L3	The display L1 shows the device address. The baud rate is displayed in display L2. The unit display flashes. Press the button 🔢 to select one of the different bus protocols (E-Bus or Mod-Bus).
	🔢 Selection		
Main menu Extra	✕ cancel or ⊖ save		If the device is equipped with the Profibus option, the Profibus protocol is also available for selection.

In the device display, the unit LED list reads: U_Ph-N, U_Ph-Ph, I, S, P, Q, cosφ, kWh, kvarh, Harmon., ● Extra

15.1.2 Set Profibus bus address

Menu	Key combination	Device display	Description
Main menu Extras			
Submenu Profibus			The display L1 shows the device address.
	▶❙ Start input mode		
Submenu Profibus Assign address	🔢 ..... ▶❙ next digit or ✕ cancel or ⊖ save		The first digit in display L1 is flashing. Press the button 🔢 to set the value of this digit. Press the button ▶❙ to switch to the next digit.
Main menu Extra	▶ or ▼		

Device display (first):
- L1: `0001` / `PBUS`
- L2:
- L3:
- ○ Uph-N ○ Uph-Ph ○ I ○ S ○ P ○ Q ○ COS φ ○ kWh ○ kvarh ○ Harmon. ● Extra

Device display (second):
- L1: `0001` / `PBUS`
- L2:
- L3:
- ○ Uph-N ○ Uph-Ph ○ I ○ S ○ P ○ Q ○ COS φ ○ kWh ○ kvarh ○ Harmon. ● Extra

> ℹ **Note**
>
> **When the Profibus setting is selected, no baud rate is set up!**
> **The device automatically detects the required baud rate.**
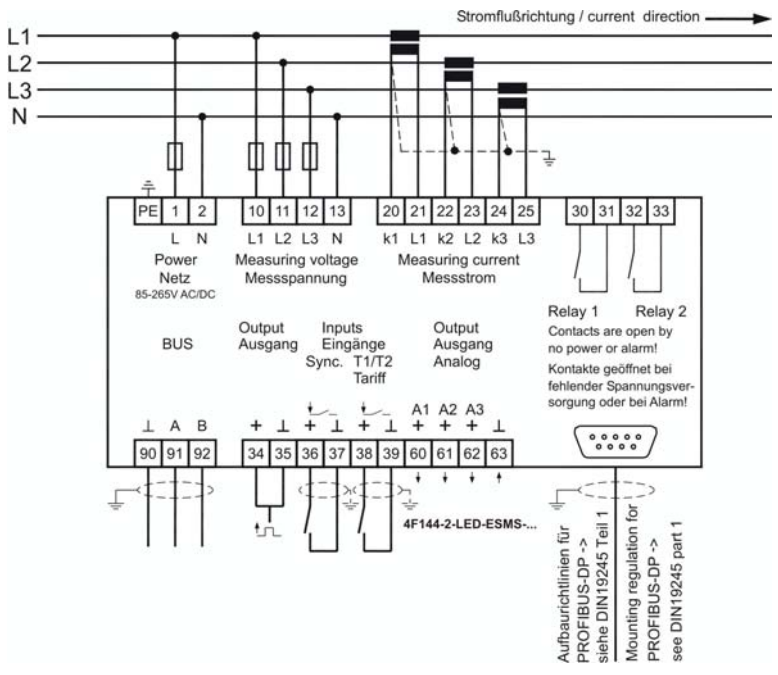
An
KBR GmbH
Abteilung Entwicklung
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To
KBR GmbH
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Vorschläge:
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